Gravel Mining Area
Land Use, Transportation, and Utility Plan

Version 2- 3.2.2015

Contents

Introduction

In 2014, the City of Elk River undertook a land use, transportation, and utility planning effort on the 2,600-acre gravel mining area in north Elk River. With previous planning efforts, this area of the city was designated as "Development Reserve" but as completion of some of the gravel mining operations draws near, the City wanted to be proactive in setting a vision and associated land use, transportation and utility plan. The study area, shown in **Figure 1**, is situated in northern Elk River, between the northern city boundary and County State Aid Highway (CSAH 33) 33 and along US Highway 169.

This plan seeks to address the following issues:

- What is the timing of the cessation of mining operations?
- What are the desired land uses for the area, post mining?
- How can the City work with the mining companies to establish compatible reclamation plans?
- What are the necessary right of way and road needs to adequately provide access to this area?
- What are the options for sanitary sewer and water service to this area and general locations of this infrastructure?
- How much development can be supported through an extension of the existing sanitary sewer and water systems, short- and long-term?
- How will access and visibility be managed?
- Are there ideal locations for regional stormwater management ponds or infiltration basins?
- How can this area accommodate future park and trail needs?
- How will neighboring incompatible land uses be protected?

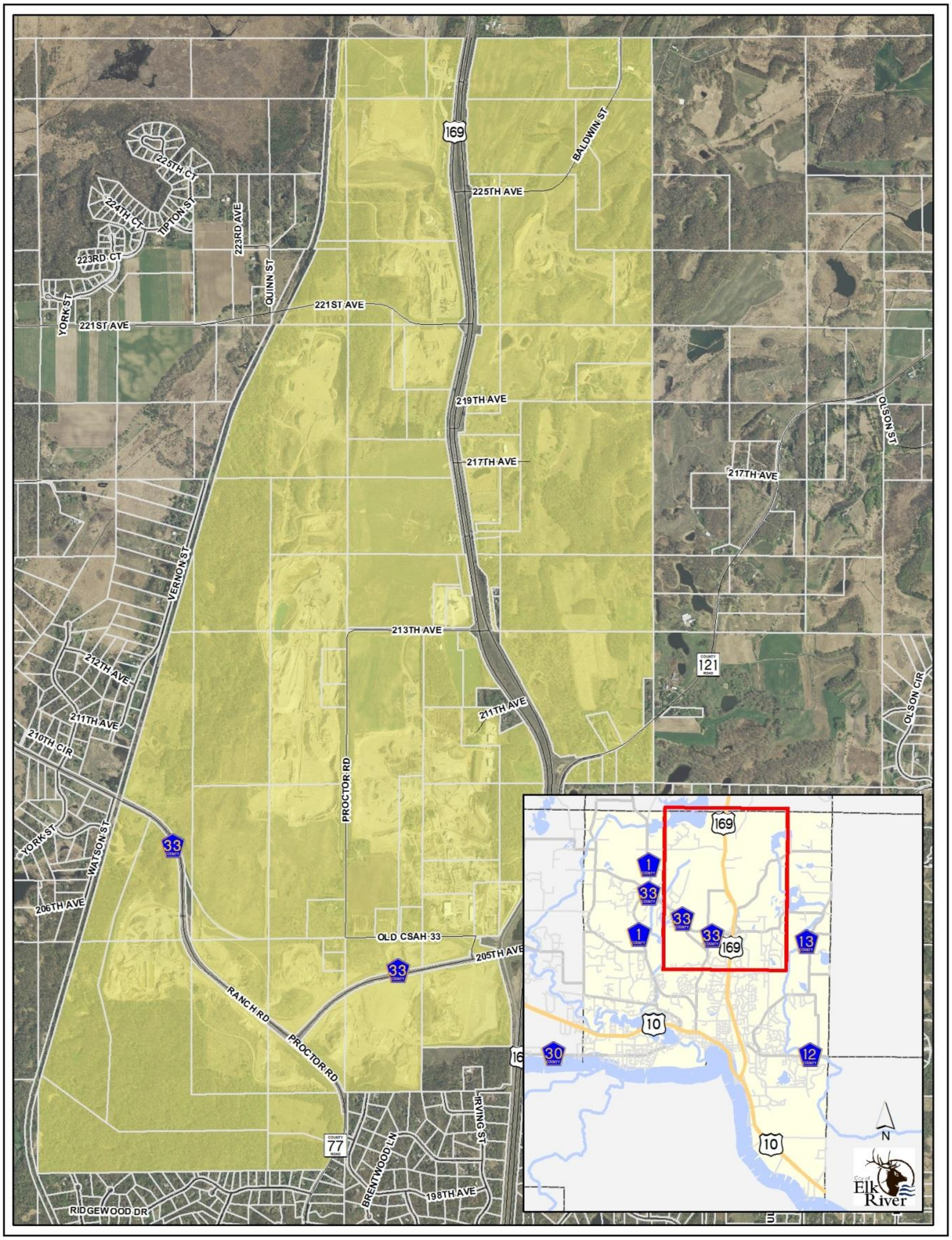


Figure 1 Study Area

Background

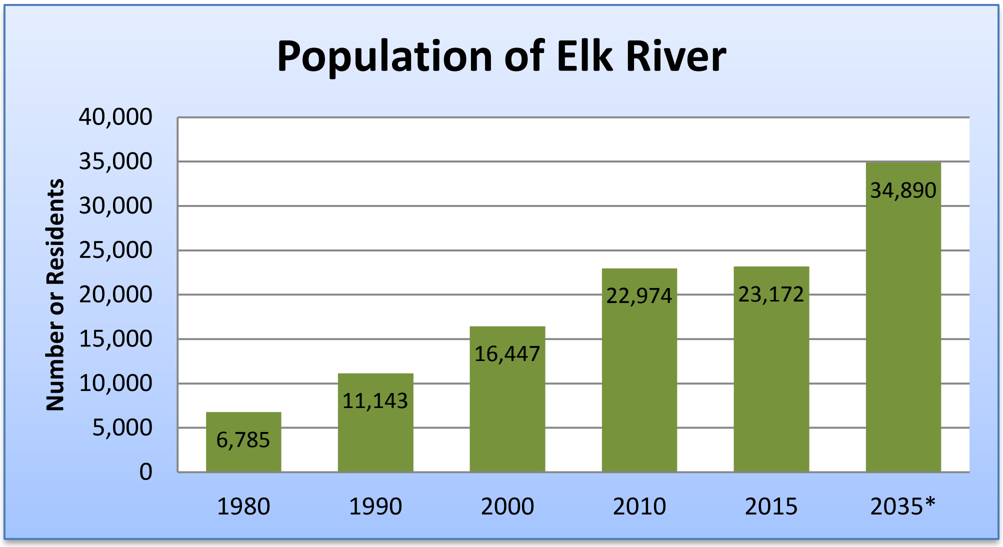
Elk River is situated at the confluence of the Mississippi and Elk Rivers in Sherburne County, roughly 34 miles northwest of downtown Minneapolis. It is bordered by the City of Ramsey to the east, the City of Otsego to the south, Big Lake Township to the west, and Livonia Township to the north. US Highways 10 and 169 and Trunk Highway 101 are the three main arterial routes that link Elk River to the Twin Cities and Greater Minnesota. The current City of Elk River covers 44 square miles. The largest area of the city was annexed in 1978 by the merging of Elk River Township. This expansion of Elk River provided the capacity for recent development. Elk River has a station on the Northstar Commuter Rail line to downtown Minneapolis.

Study Area

Existing land use in the study area is primarily mining, but there are also several hundred acres that are open space, landfill, rural industrial, rural residential and parkland. The City's Comprehensive Plan, completed in 2014, guided the property in the study area as "Development Reserve" to allow for future land use planning efforts as mining activities are exhausted. The mining area also has a zoning overlay guided as development reserve. The overlay allows the City of Elk River to plan for land uses in this area before development pressure occurs.

Housing Needs

Elk River has experienced a significant change in population over the past 30 years, with more growth expected in the future. In 2000, the population was 16,447, and in 2010 the US Census documented a population of 22,974. The City of Elk River anticipates a total population of 34,890 by 2035, according to the 2014 Comprehensive Plan. Historic growth patterns and future projections are shown in **Figure 2.** Based on the population projections, Elk River will need to add more housing units to accommodate to its housing stock in order to accommodate the additional population. Also, as the national trend of decreasing household size continues, a variety of types and styles of housing will be needed to provide options for smaller households. In 2010, Elk River had approximately 8,500 housing units. Based on future population projections and trends in household size, an 4,000 housing units will need to be planned for over the next 25 years. The Gravel Mining Study area could accommodate a large amount of this planned growth.



*Future population projection

Figure 2: Population Trends

Employment Needs

In 2010, Elk River's unemployment rate of 5.5 percent was slightly higher than the state average of 4.9percent and the Sherburne County rate of 5.3 percent. Elk River's median household income was higher than both the state and county levels. The poverty level in Elk River was lower than both the county and state levels. Currently, most employment opportunities in Elk River are in the business, service, and sales/office sectors **(Figure 3).** These sectors comprise approximately 78 percent of the jobs within the community. About 13 percent of jobs are in production or transportation sectors.

The City of Elk River could benefit from greater job opportunities in the production, distribution, manufacturing industries. Furthermore, staff and residents expressed a need for this type of land use in the gravel mining area. Therefore, a focus of this study will be providing opportunities for such development. However, without residents, the need for employment is limited. Therefore, a balanced approach to land use planning is needed.

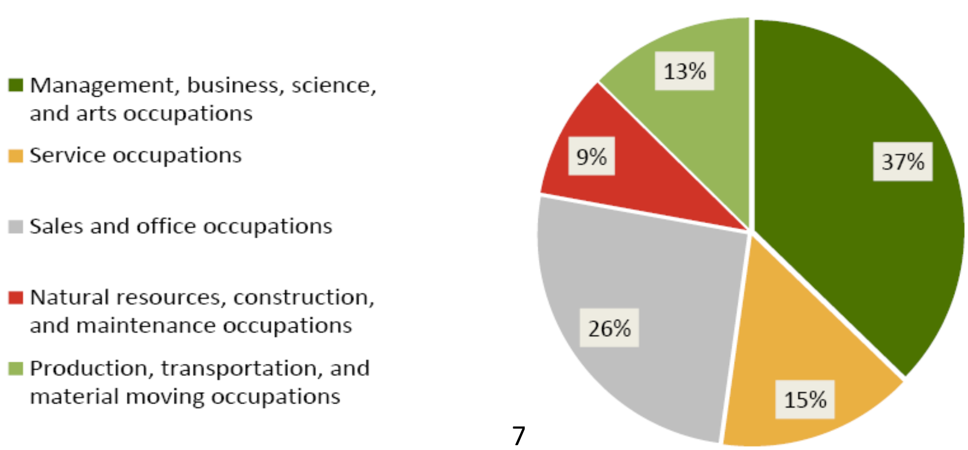


Figure 3: Employment by Industry

Vision

Like the 2014 Comprehensive Plan, the gravel mining area plan outlined in this document reflects current community interests and vision for the area. The community is setting a plan to follow so that the vision becomes reality. As part of this study, a community visioning session, an online engagement tool, and a series of focus groups were completed that included property owners, gravel mining companies, City staff, Elk River Municipal Utility (ERMU) staff, the general public, and elected and appointed officials. A list of the comments from all the input sessions is included in Appendix A.

Overall, input and feedback reflected a strong desire to have more land designated for industrial areas, parks and open space, with less land dedicated to residential development. Another key priority based on community input was the need to identify a vision, and stick with it to fruition. Conversely, some input reflected the importance of flexibility to accommodate a variety of land uses that might be in demand over a particular short-term period.

In summary, people wanted to see more jobs, retail options, and parks and open space. This study includes all of these priorities. **Figure 4** summarizes the comments received regarding desired land uses.

Below is a summary of the other important priorities for residents, property owners, and attendees of community input sessions:

1. The plan needs to include a mix of uses (diversified) and have patience to see the plan through;
2. Identified industrial uses should be "clean" industrial – not heavy industry;;
3. The plan needs to provide adequate infrastructure – roads, trails, sewer, water, etc.;
4. Recreational uses – parks and trails with active and passive areas is important; and
5. Retail opportunities need to be more diversified than current "big box" options.

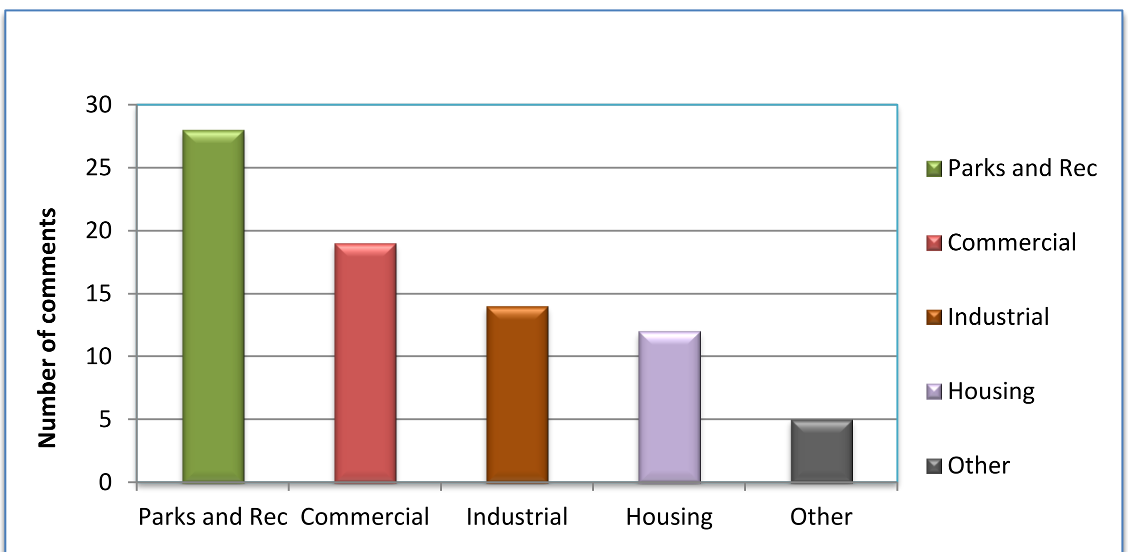


Figure 4: Desired Land Uses

Concerns and Unwanted Land Uses

The community also voiced land uses they would not like to see. "Dirty" industrial uses were clearly rejected by community input. Members of the community were adamant that they did not want pollution or noise from large industrial sites. They did not want anything that may have an undesirable appearance. Community members also did not want to see more sprawl and congestion problems. Some also mentioned that they would not like to see more big-box stores or retail centers in the area due to their poor landscaping and low paying jobs. People also voiced concerns over design and layouts of roads and utilities (no visual power lines or plants) as well as the costs associated with utility extension. Many people mentioned the need for well connected, functional road ways that are easy for traffic movement and way finding. Participants shared a concern over businesses having ample lot sizes so that when a business grows, it has plenty of land to expand on.

Property Owners Input

In consultation with the property owners within the gravel mining area, valuable discussions related to when mining operations would cease occurred. This information is summarized in **Figure 5** below. This information was consulted when developing the land use plan and, more importantly the phasing plans for this study. Most of the gravel mining area will not be done mining for at least 15 years.

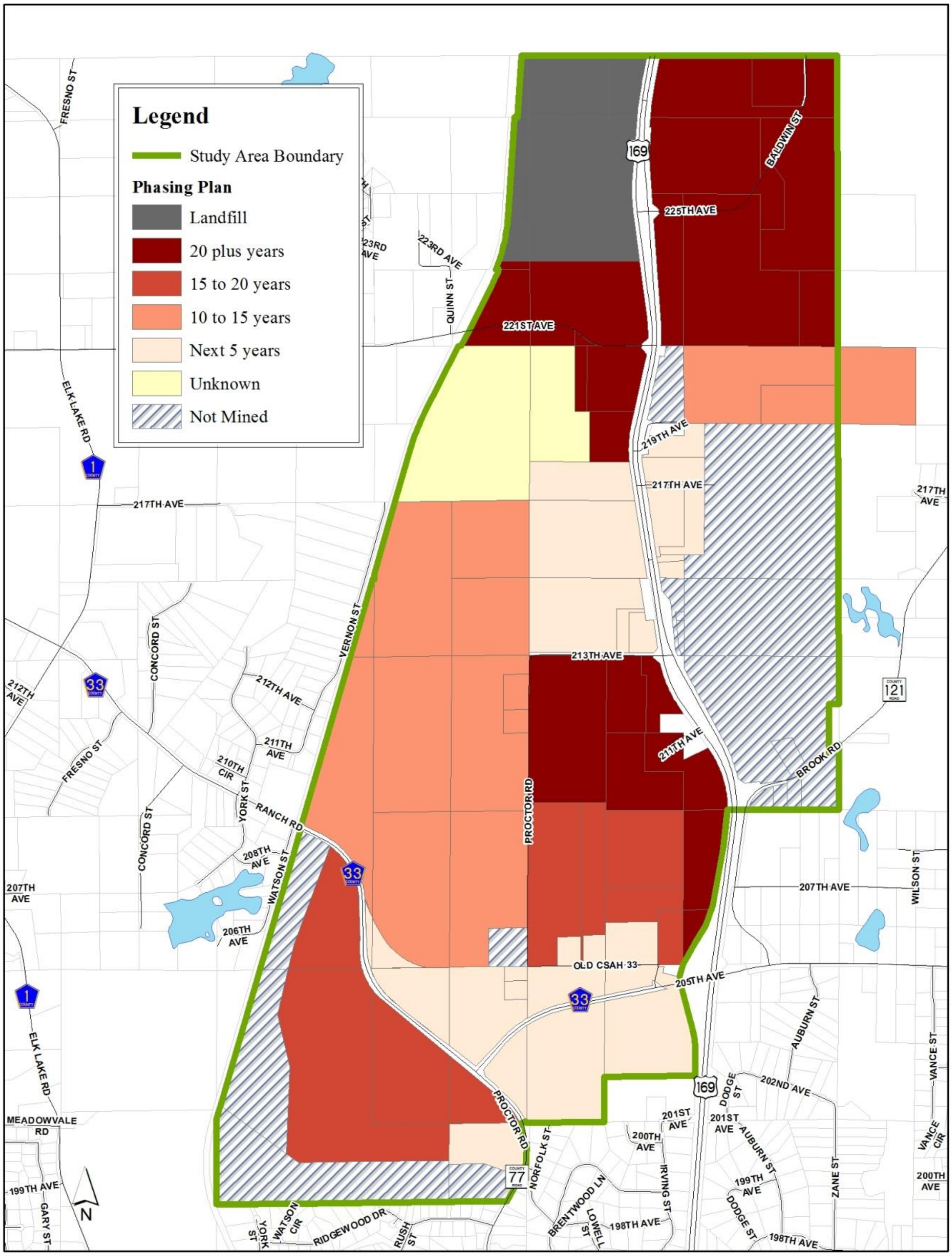


Figure 5: Timing of Gravel Mining Cessation

Analysis of Opportunities and Constraints

Utilities

The Elk River Municipal Utilities (ERMU) provides electric and water services to Elk River and surrounding areas and is responsible for the construction, operation and maintenance of these systems. The Utilities Commission serves as the governing body for ERMU. Wastewater treatment and storm water management are the responsibility of the City Council and City staff.

Previous Planning Efforts

In 2013 the City underwent a study and investigation of the sanitary sewer system capacity. Sewer capacity (or the lack thereof) influences the type and intensity (density) of development. It also influences the timing and private and public costs to extend capacity to future developable areas within the gravel mining area. While the study completed in 2013 addresses many of the questions pertaining to capacity gained through expansion of the wastewater treatment plant and the financial implications of making these improvements, continued study and analysis of the future sanitary sewer system will be critical for future planning efforts. **Figure 6** shows the area that was considered when sizing the upgrades to the wastewater treatment facility.

The Comprehensive Plan includes information about the utility needs that the City of Elk River has now and into the future. However, the limitations of the utility system influence the type, form and location of future development.

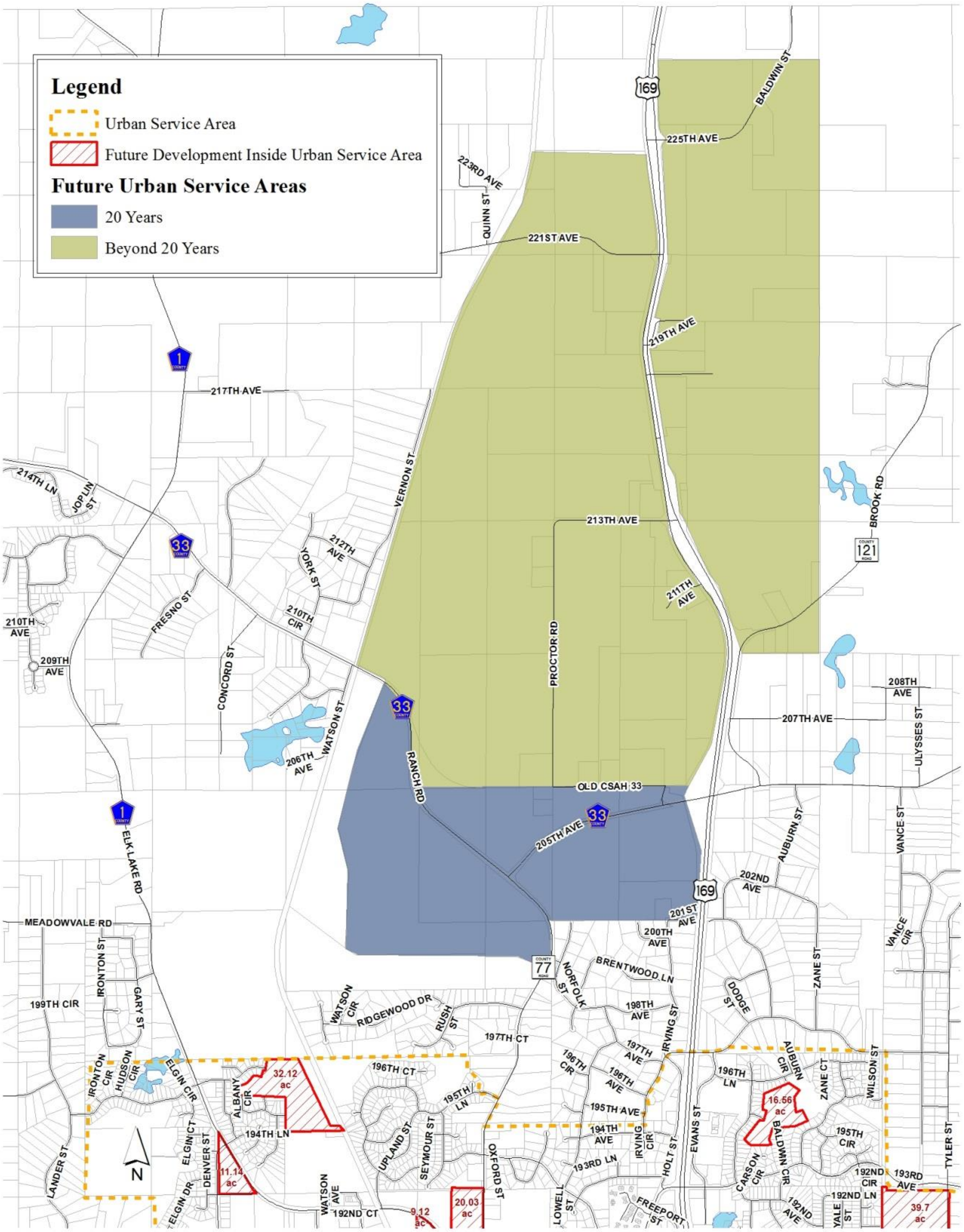


Figure 6: Urban Service Area-From Sanitary Sewer Planning Efforts

A sufficient water supply is also a fundamental prerequisite for community growth and sustainability. Obtaining, protecting and distributing drinking water that meets health standards is one of the most important functions performed by a community. In addition, water pressures must be maintained for health, convenience, safety, and to meet multiple and simultaneous demands by local residents. It is also important to maintain adequate water pressure and supply for fire protection. The City must maintain and expand its present system to ensure reliability and meet increasing water demands and quality standards. Much more study will be needed to analyze the particular improvements needed to the water system to adequately provide water service to the gravel mining area; however this study identifies high-level needs regarding lift stations, water towers, wells, and ideal locations for these investments, and provides a phasing framework for planning ahead for these items.

Transportation

The transportation network provides access to the various land uses and amenities within a community. It also provides connections to adjacent communities, the Twin Cities metropolitan area, and Greater Minnesota. Because transportation, be it roadway, transit, or pedestrian/bicycle, plays a critical role in how a community is served, planning for changes and upgrades to the network is an important part of a small area plan. It also requires coordination and cooperation with multiple agencies to ensure that transportation needs are being met. Unlike land use, over which the City of Elk River has sole jurisdiction, the transportation network has multiple owners. Some roadways are developed and maintained by the City, while others are controlled by Sherburne County or the Minnesota Department of Transportation (MnDOT).The transit system and bicycle and pedestrian networks can also be developed by the City and by outside agencies such as the County and the State.

Many of the City of Elk River's most important roadways are maintained by other agencies, such as US Highways 10 and 169 (by MnDOT) and County Highways 1, 12, 13, 30, 33, 35, 40, 44, and 121 (by Sherburne County). These roadways are maintained by other agencies because of the roles they play in linking communities and other transportation facilities. US Highway (US) 169 is one of the state's most important roadways. It provides a north-south connection through most of the state, including the City of Elk River and nearby communities such as Zimmerman and Princeton to the north and to Ramsey, Anoka and Champlin to the east. It also provides important links to nearby east-west and north-south roadways, including US 10, TH 101, County State Aid Highway (CSAH) 33, CSAH 12, etc.

Previous Planning Efforts – US 169

Because of its role in the transportation network, MnDOT, Sherburne County and the City of Elk River have invested significant resources in studying US 169 and developing long-term recommendations for its ultimate design (freeway facility). These efforts have included identifying interchange and overpass locations, as well as the supporting transportation network that is needed to accommodate future changes in population and land use. These efforts began with the Interregional Corridor Study for Highway 101/169 in 2002 and were further supported by the completion of an Environmental Assessment/Environmental Assessment Worksheet (EA/EAW) for US 169 which was finalized in 2013.

The EA/EAW indicated the need for interchanges at CSAH 33 and at 221st Street and included a concept for an interchange at 221st Street (CSAH 33 already exists). The EA/EAW also included projected traffic volumes for US 169 and nearby roadways in the future. These projections indicated that future volumes on US 169 are anticipated to be in the range of 64,000 cars/trucks a day through the study area in 2030. It should be noted that the future forecasts did not include the land use scenarios studied in this plan. At the time the EA/EAW began, the study area was slated for mining and the intensity of development in the immediate project area was less (based off of the previous Elk River Comprehensive Plan).

Improvements identified as part of the US 169 EA/EAW included the following:

- Ultimate six-lane facility (initially constructed as a four-lane freeway that can be modified)
- Auxiliary lanes and collector-distributor between Main and School Streets and School Street and 193rd Avenue.
- US 169 is lowered (reduces reconstruction of local roadways that cross over the highway)
- US 169 is shifted slightly to the east near BNSF Railway
- BNSF Railway shifted
- Existing interchange at US 10/US 169/TH 101 is upgraded to better channel all movements
- Interchange at Main Street
- Interchange at School Street
- Interchange at Jackson/193rd Avenue and 197th Avenue (split diamond)
- Interchanges at 205th Avenue/CSAH 33 (already constructed)
- Interchange at 221st Avenue
- Frontage and backage roads
- Accommodations for pedestrians and bicyclists to cross both US 10 and the railroad
- Pedestrian and bicycle trails/sidewalks along crossings and frontage roads

All other public street and driveway access will be eliminated from the corridor, with access provided at the interchange locations. **Figure 7** shows improvements identified as part of the US 169 Environmental Assessment. It should be noted that no funding has been identified for the US 169 improvements, nor has any timeline been established for their construction. For purposes of this study, the proposed interchange at 221st Avenue has been included as an improvement that would be constructed prior to 2040.

Previous Planning Efforts – Elk River Comprehensive Plan

Following the completion of the draft EA/EAW, the City of Elk River updated its own Comprehensive Plan. As part of that effort, a future roadway network plan was developed that included new roadways, some realignment of roadways and interchange information from the EA/EAW. Information from Sherburne County's Transportation Plan helped to inform the City's Transportation Plan and the future roadway network. **Figure 8** shows the roadway network for the main transportation corridors identified in the City's Comprehensive plan.

The future roadway network includes key routes identified by their functional classification. A roadway's functional classification gives an indication of the relative importance of the roadway in the transportation network. Roadways that are classified as principal arterials are the most important roadways – they generally link several communities within and beyond county borders and provide for the greatest mobility. Access to these roadways is generally limited and speeds are generally higher. These roadways can be freeways or expressways. Connections to other principal and minor arterial roadways are important. Principal arterials are usually owned and operated by MnDOT.

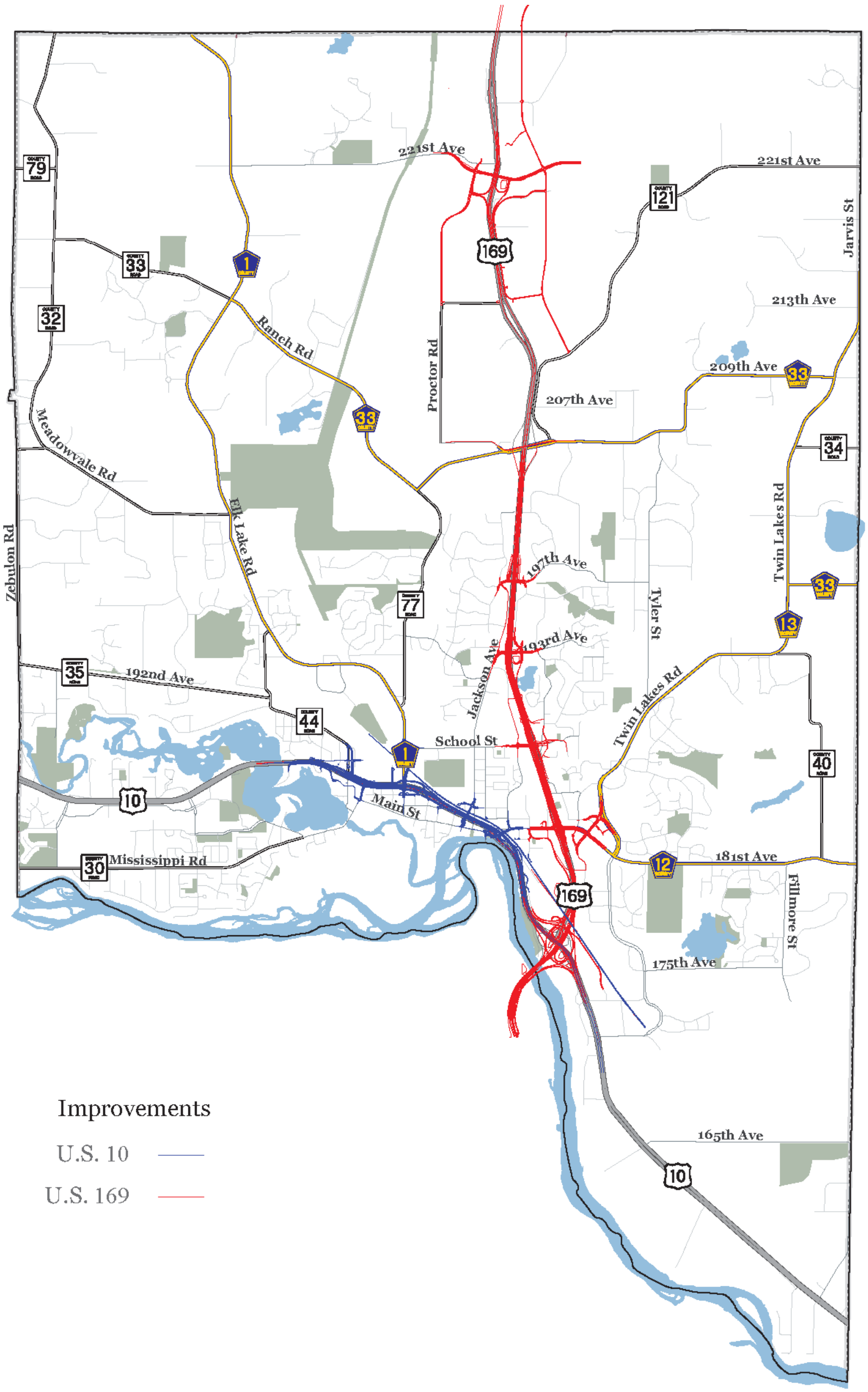


Figure 7: Identified Improvements for US Highway 169- From EA/EAW

Figure 8: Proposed Roadway Network - from Comprehensive Plan

Roadways classified as minor arterials are intended to provide links between two or more communities. Access to these facilities is also limited, but not to the extent that it is on a principal arterial. Like principal arterials, mobility or moving traffic is a high-priority. Generally other minor arterials and collector roadways connect to minor arterials. Minor arterials are usually owned and operated by MnDOT and the counties, although a few cities have jurisdiction over minor arterial routes.

Collector (both major and minor) roadways provide linkages to larger developments and community amenities. They generally do not link communities to one another. Collector roadways generally favor access to the system over mobility, but they try to balance to two competing needs. Collector roadways are generally lower speed than the principal or minor arterial routes. Collector roadways are usually owned and operated by cities, although counties have some of these facilities.

As can be seen in **Figure 8**, the roadway network in the Elk River Comprehensive Plan has a limited number of existing and proposed continuous north-south and east-west roadways classified as collector roadways or above. This is a result of previous development patterns and limited opportunities to remedy those patterns without significant disruptions to existing neighborhoods and developments. The lack of east-west and north-south connectivity within the community and the study area will result in traffic being concentrated on US 169, 221st Avenue and CSAH 33 as well as Proctor Road (and its extension) and the eastern backage road to US 169.

Information from the US 169 EA/EAW, as well as the City's updated Comprehensive Plan, was the starting point for developing roadway alternative scenarios for this study. It should be noted that coordination between the City, Sherburne County and MnDOT will be required to implement the transportation improvements identified in this study as well as those in the US 169 EA/EAW and the City's Comprehensive Plan.

Existing Traffic Volumes and Capacity in Study Area

Traffic volumes and existing intersection traffic control for roadways within the vicinity of the Mining Area study area are shown in **Figure 9. Table 1** lists existing roadway volumes by design type. Existing traffic volumes on the primary routes in the study area are generally below their capacity. Roadways below capacity (have less traffic than they were designed to accommodate) generally do not experience significant congestion and generally operate at an acceptable Level of Service (LOS).

Table 2 shows general planning-level capacities for different roadway designs. The thresholds provide a general understanding of when a roadway is likely to experience congestion. It should be noted that a number of factors can influence the capacity of a roadway, including: speed, the amount of access, the directional split of traffic, peak hour percent, saturation flow rates, and other factors that are not reflected in the planning-level thresholds.

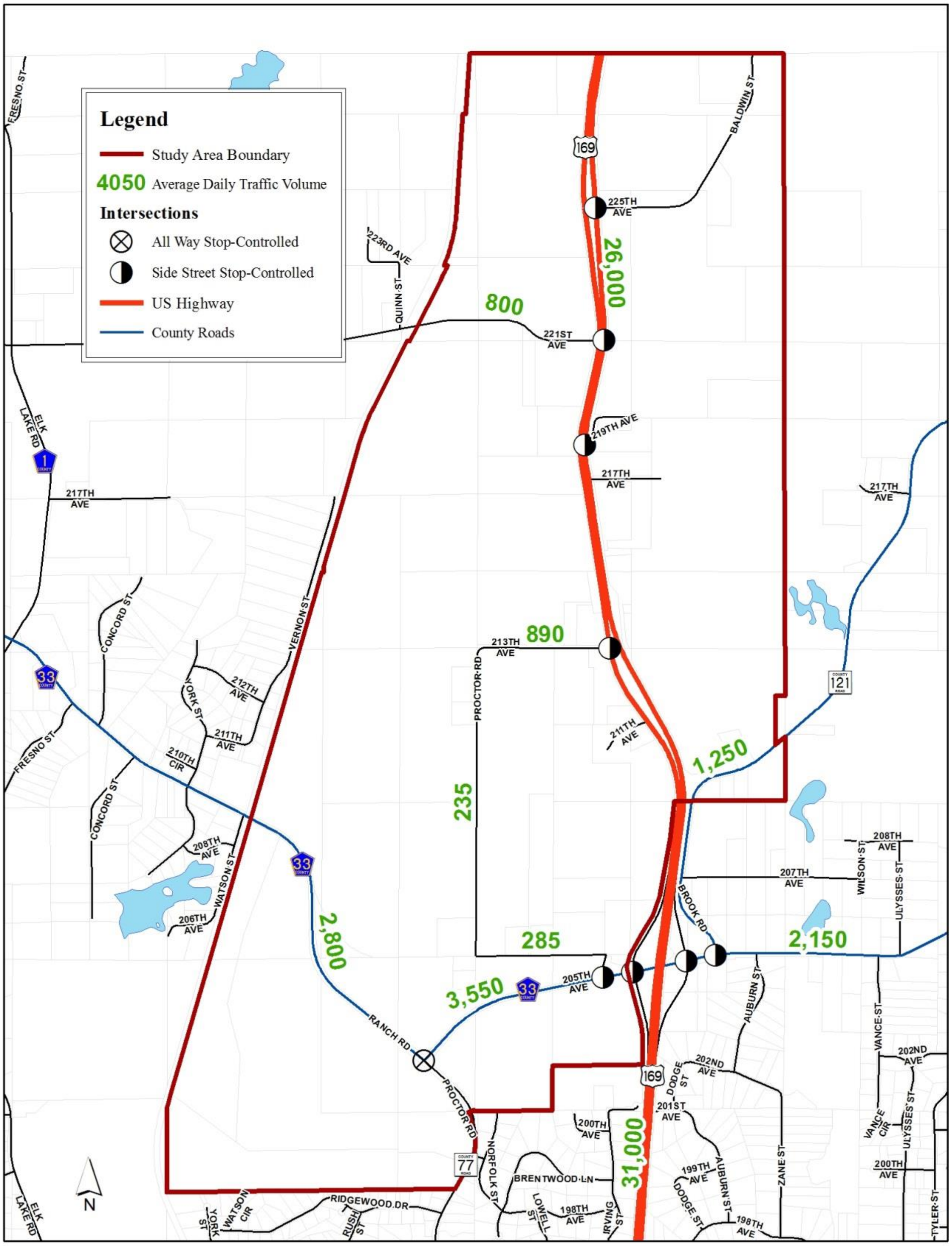


Figure 9: Existing Roadways and Traffic Volumes

Table 1 – Existing Traffic Volumes

Roadway	From	To	Design	Existing Traffic Volumes
US 169	CSAH 33	221st Avenue	4-lane rural expressway	26,000
CSAH 33	Western study limits	Western interchange approach area	2-lane rural roadway	1,800 – 3,550
CSAH 33	Western interchange approach area	Eastern interchange approach area	4-lane divided	2,950 – 3,550
CSAH 33	Eastern interchange approach area	The east	2-lane rural	2,150
CR 77	CSAH 33 intersection	South study limits	2-lane, rural	Not reported
CR 121	CSAH 33	Eastern study limits	2-lane, rural	1,250
Proctor Road	Old CSAH 33	213th Avenue	2-lane, rural – local road	235
221st Avenue	CSAH 1	US 169	2-lane, rural – local road	800

Table 2 – Planning-Level Capacity Thresholds

Roadway Design	Planning-Level Capacity
Two-lane, urban	8,000 – 10,000
Two-lane, rural	12,000 – 15,000
Two-lane, local roadway	< 8,000
Three-lane	15,000 – 18,000
Four-lane, divided	28,000 – 32,000
Four-lane, rural expressway	36,000

Analysis of Alternatives

As part of this study, three land use scenarios were prepared, and input was collected from the general public through an online poll, the members of the Park Commission, and at a joint work session with Planning Commission and City Council. There were common components to the three scenarios, including the parks and open space areas as designated by the Comprehensive Plan. Also, all three areas anticipated the eventual limiting of access off of US 169 and an interchange at 221st Avenue.

Land Use Scenario 1

The first alternative offers a mix of land uses, with industrial being the primary land use as shown in **Figure 10**. Commercial and light industrial is positioned close to US 169 to offer visibility to businesses and easy access to employees and patrons. The highlight of this option is having a dedicated industrial area in the first phase of development. The residential indicated in this scenario is urban residential and is located on the far eastern side with some along a future collector on the western side. Residential is minimized in this scenario.

Land Use Scenario 2

The second alternative, shown in **Figure 11,** provides the most commercial options, located primarily along US 169. It also includes the most options for residential development, with a combination of rural residential and residential on city services. This scenario provides options for high density housing (the only option with that dedicated land use) in the northern portion of the study area. While a large amount of land area is guided for industrial, it has the least of the three options.

Land Use Scenario 3

The key component of the third land use scenario **(Figure 12)** is a flex use land use district. This area allows for a variety of land uses, based on the market demand and need. While including much area for industrial and residential development, the flex use area allows for any type of development. The third scenario also guides a large amount of area in the northern portion of the study area for rural industrial, which acknowledges the need for immediate industrial development that does not have access to sewer and water facilities for a number of years.

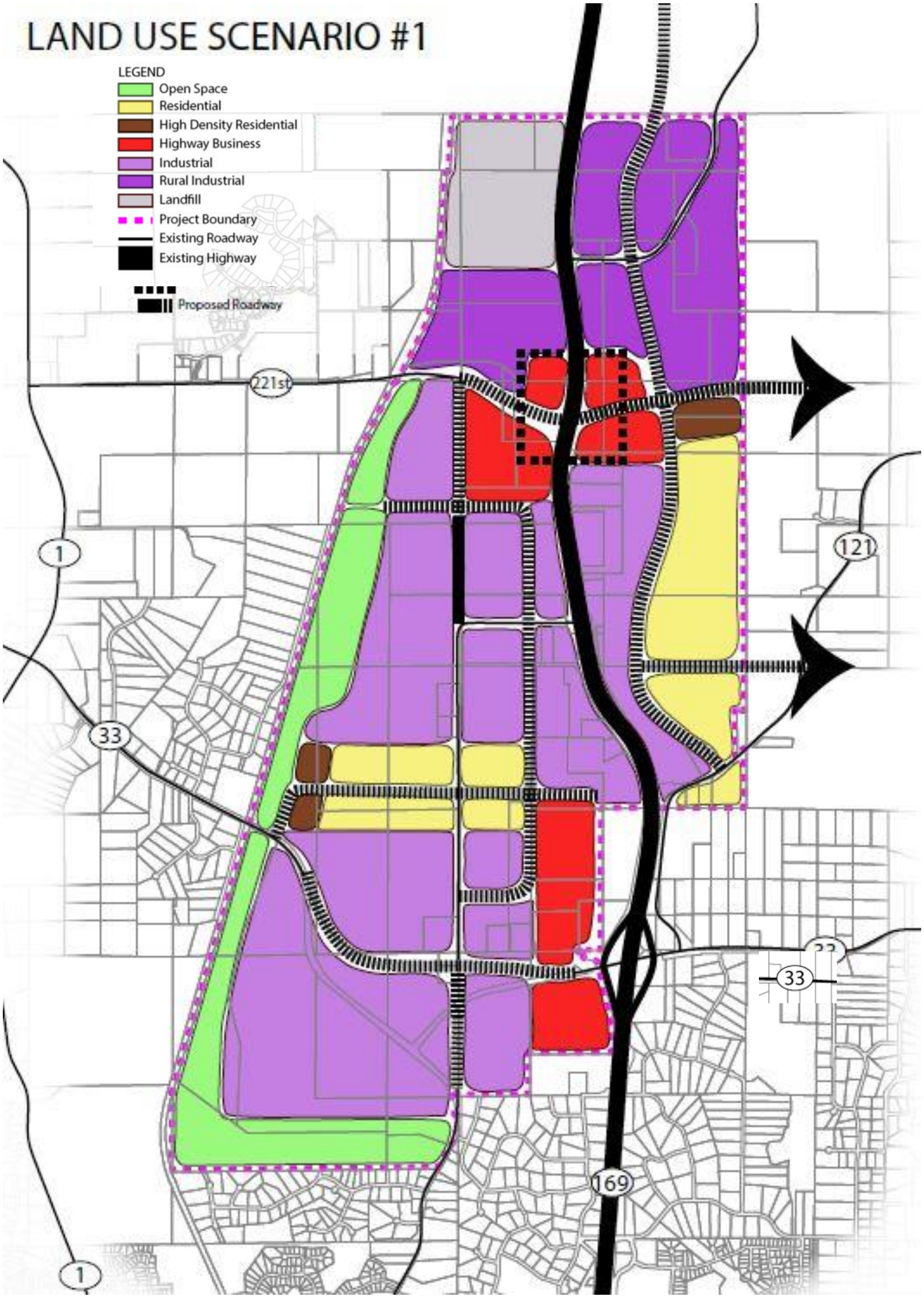


Figure 10: Land Use Scenario 1

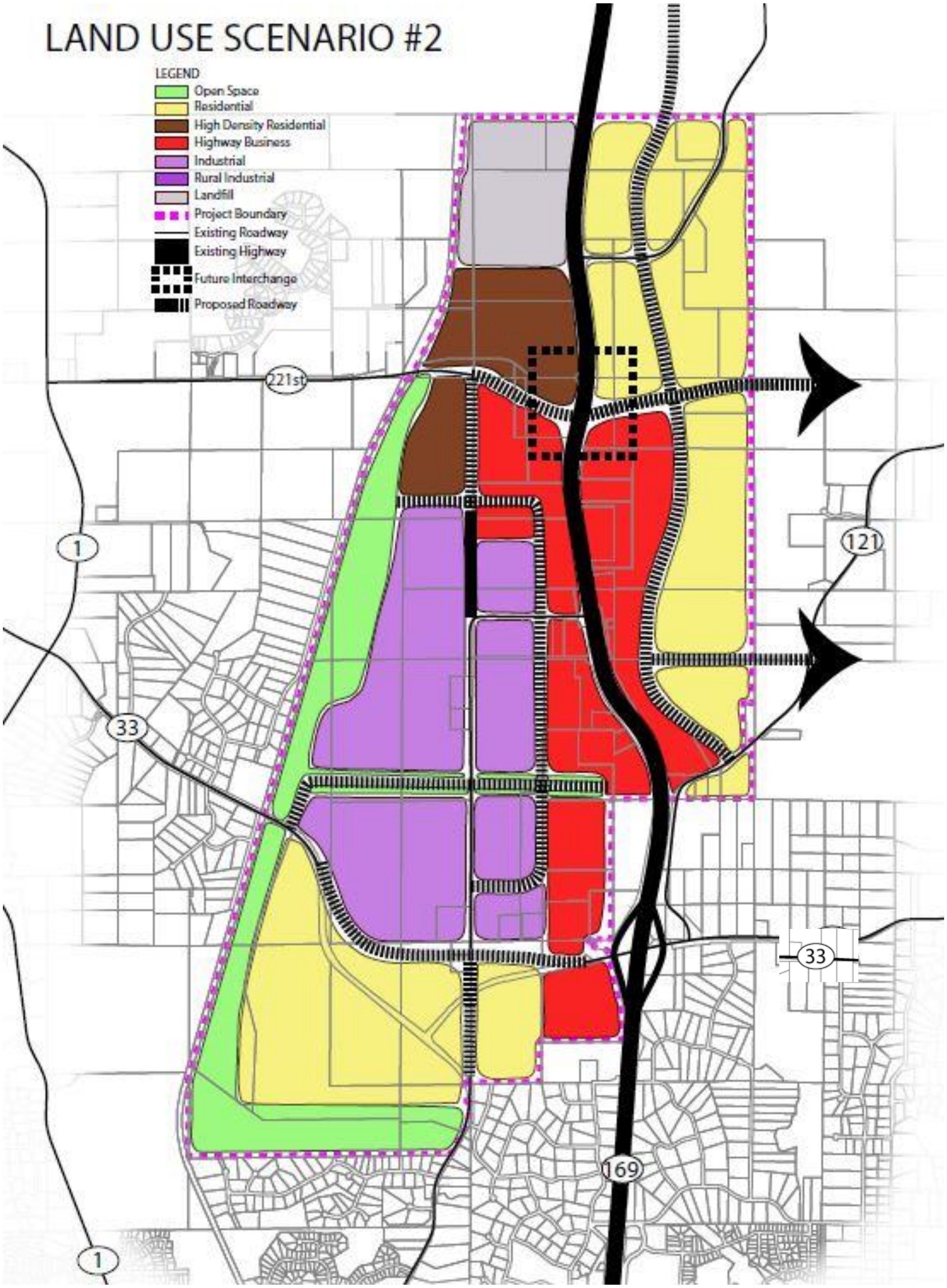


Figure 11: Land Use Scenario 2

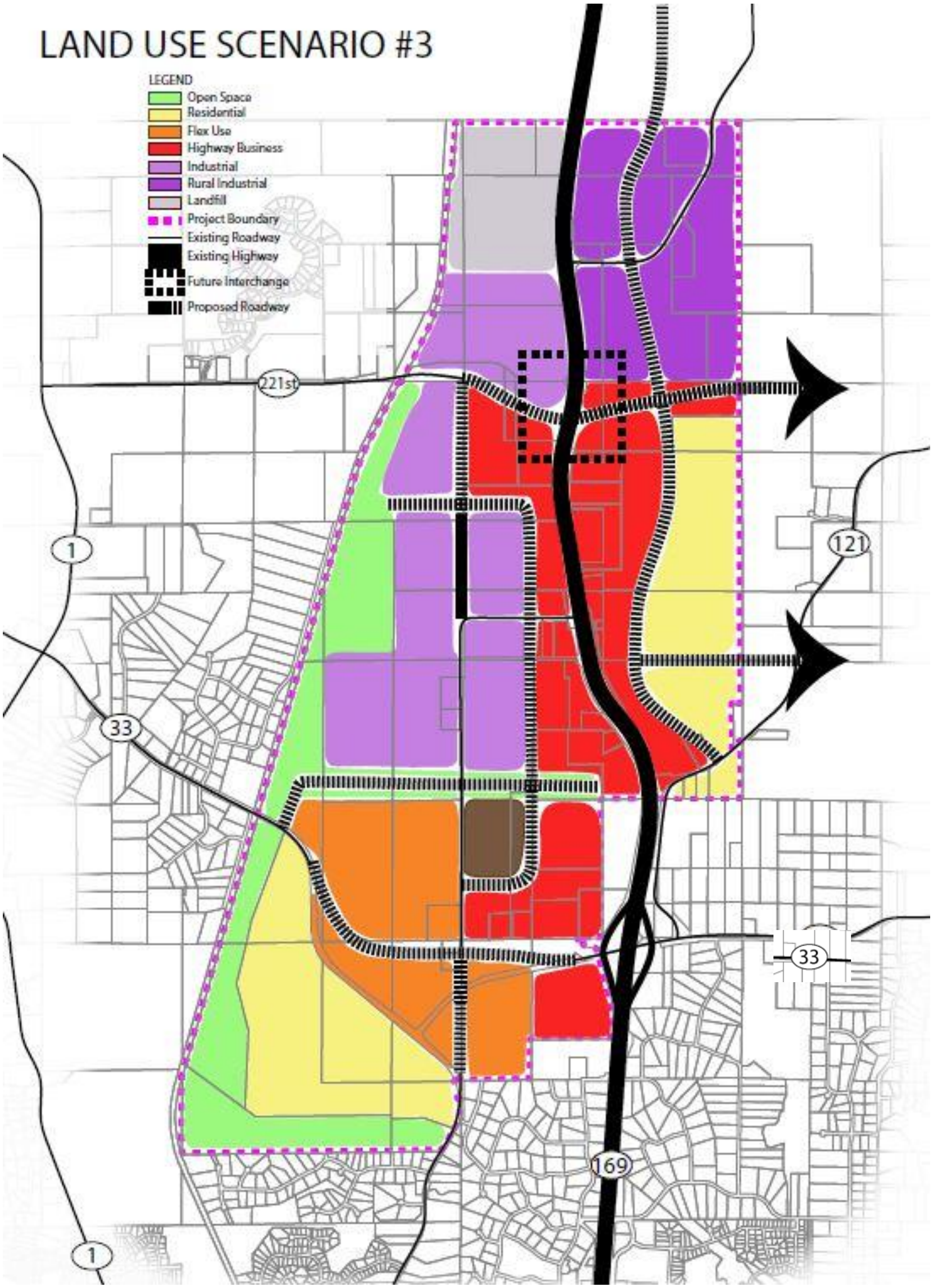


Figure 12: Land Use Scenario 3

Roadway Options

In addition to developing land use scenarios, this study included the development of two roadway alternatives. These alternatives are based off of information contained in the US 169 EA/EAW and the City's 2014 Comprehensive Plan. Input from the public, as well as elected and appointed officials, was also used to refine the potential concepts.

Based on the changes in the overall collector and arterial roadway system in the recently revised Comprehensive Plan, it was necessary to analyze whether the existing alignment of County State Aid Highway (CSAH) 33 was appropriate. The removal of an east/west collector road west of the study area, combined with the need for additional continuous north-south roadways through the study area, necessitated a re-examination of the alignment. **Figures 13** and **14** show Roadway Options 1 and 2.

Option 1 keeps the intersection of CSAH 33 and 205th Street at T-intersection.

Option 2 realigns CSAH 33 to intersect with Proctor Road.

Figures 13 and **14** show the proposed roadway network options for the immediate study area. It needs to be understood that other roadway connections identified in the City's Comprehensive Plan (such as the extension of 221st Avenue and Tyler Street) as well as the US 169 EA/EAW (such as the interchange and access closures) will be needed to support the proposed development in the study area.

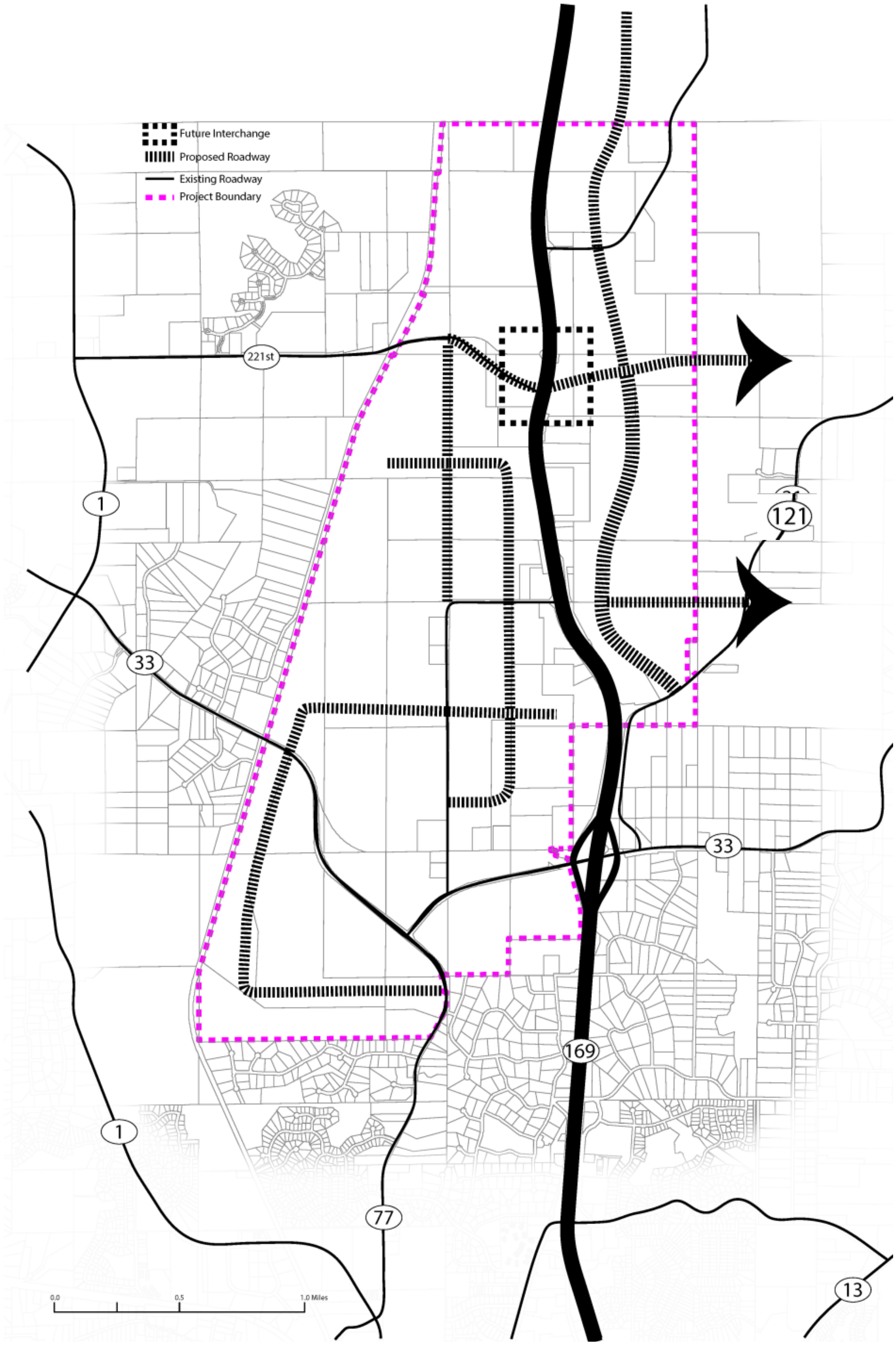


Figure 13: Roadway Option 1

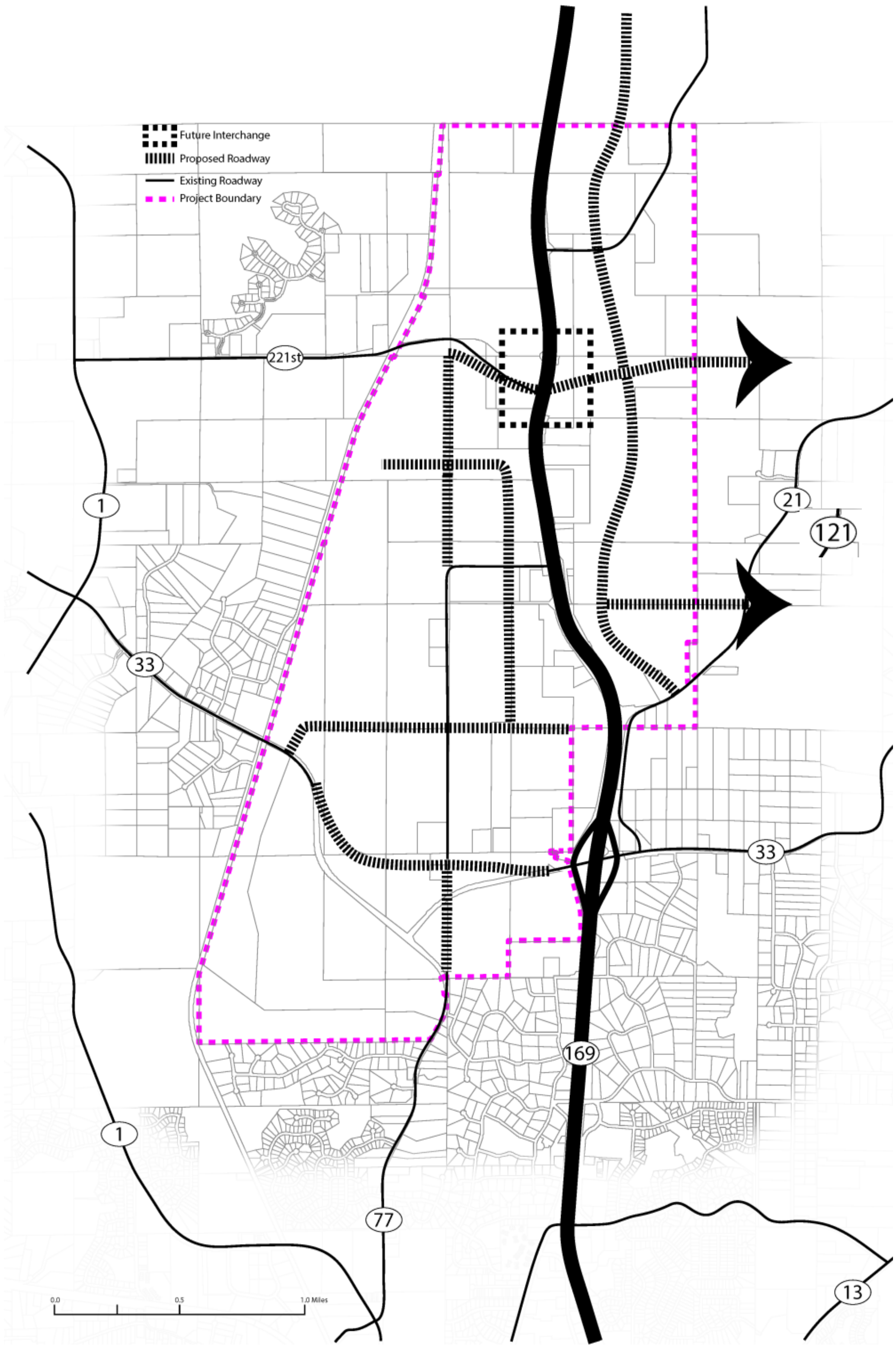


Figure 14: Roadway Option 2

Final Land Use and Roadway Plan

After discussion with Parks, Planning Commission, and City Council, and collecting input from the general public, staff and property owners , a final land use and road scenario was selected. Taking most of the aspects of the third scenario and choosing “Roadway Option 2” with some modifications, a final land use and transportation plan was produced. Roadway Option 2 includes the re-alignment of CSAH 33, which would create an important east/west connection from US 169 through the study area.

The Final Land Use Plan for the entire gravel mining area is shown on **Figure 15**. Once selected, final utility, transportation, and grading plans were completed, based on the preferred alternative. The Final Roadway Option is shown in **Figure 16,** which highlights the new roadways needed.

Upon analyzing the constraints of the transportation and utility systems, a phasing plan was applied to the preferred land use scenario to be strategic in identifying near-term and long-term investment needs and to acknowledge that Elk River will not need to provide development opportunity in the entire 2,600 acres at once. When analyzing utility and transportation constraints and in discussions with property owners, it was necessary to develop a phasing plan to provide the City with a realistic and implementable plan that recognized the significant financial investments required to fully serve the entire study area.

This study anticipates the needs for utilities, transportation, and stormwater infrastructure for “Phase 1” and “Phase 2” (through 2040) as highlighted in **Figure 17.** Phases 1 and 2 are 724 acres, and have been identified based on the anticipation completion of the mining operations. Below are the assumptions used when calculating land uses and lot coverage for the purposes of analyzing transportation, utility, and stormwater needs for the preferred land use scenario:

	Acreage-Phase 1	Acreage - Phase 2	Number of Homes	Lot Coverage (% and Square Footage) –Phase 1	Lot Coverage (% and Square Footage) – Phase 2	Impervious Surface
Low density residential (1.5 u/a)	136	0	204			30%
Medium density residential (4 u/a)	138	0	552			45%
Highway Business	78	114		20% (679,536 sq. ft)	20% (993,168 sq. ft)	75%
Commercial/Industrial Flex (50/50)	178	80		25% (1,938,420 sq. ft)	25% (871,200 sq. ft)	75%

Additionally, there is an opportunity for immediate, rural residential development in the areas designated as “residential” on the eastern side of US 169. These areas could develop without municipal utilities, if they were developed with the assumption that the homes in the development would eventually connect to urban services (once available). Residential development should occur as cluster development on community septic systems that are designed to connect to the public wastewater treatment system when available.

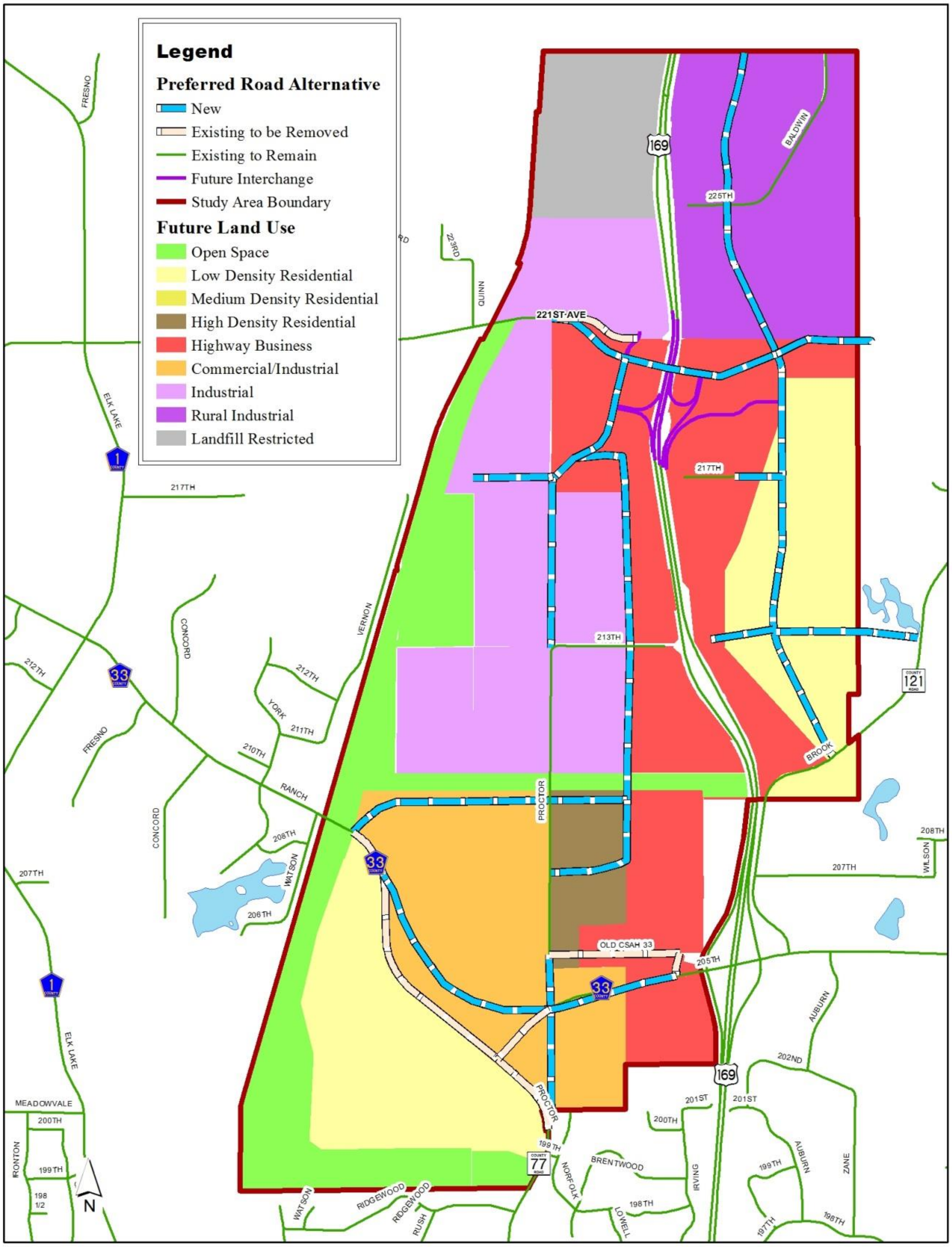


Figure 15: Preferred Land Use Scenario

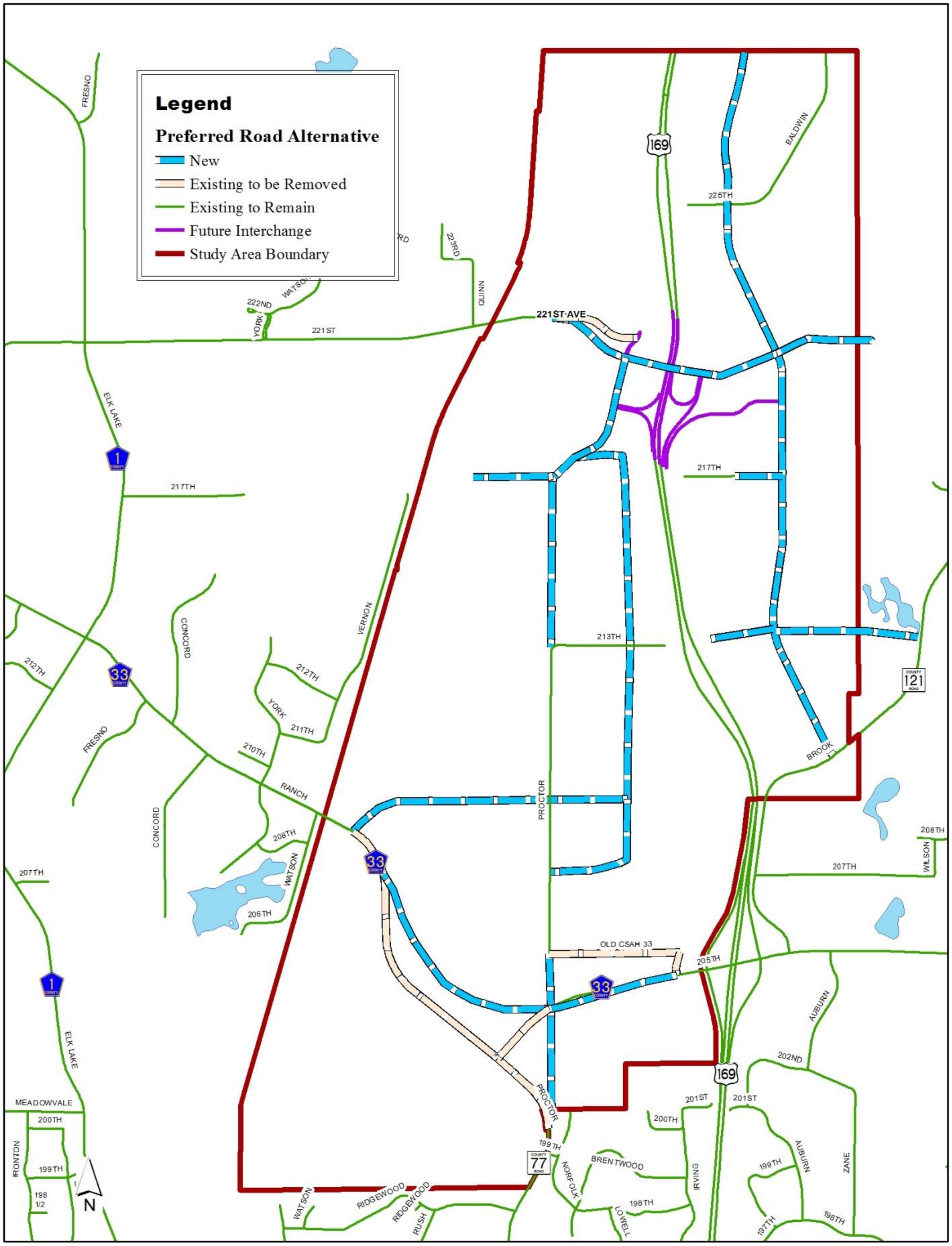


Figure 16: New Roadway Alignments

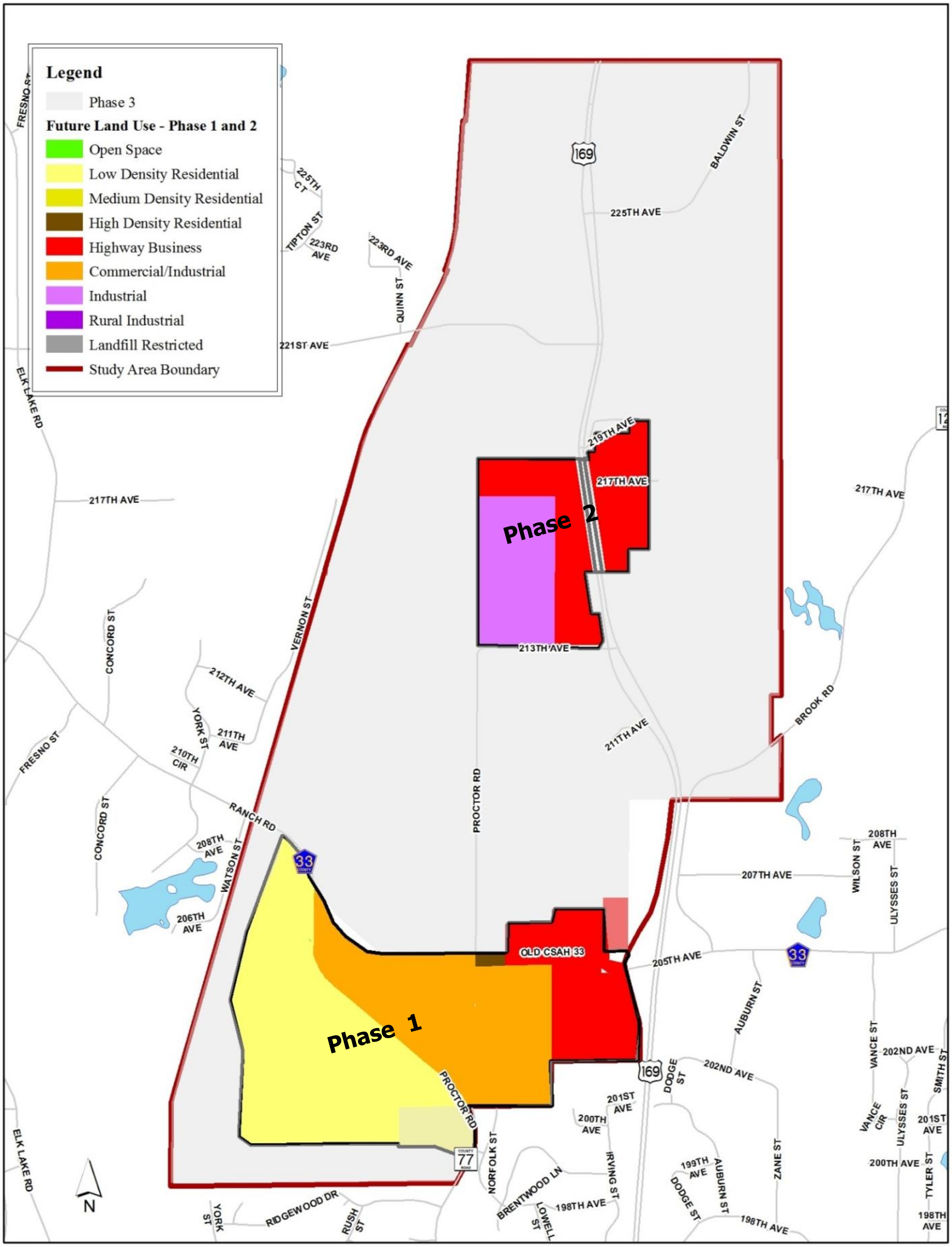


Figure 17: Phase 1 and Phase 2 Development Areas

Transportation Analysis

Upon identification of the preferred land use and roadway plan, this study evaluated the amount of traffic that would be generated and assigned to the roadway network. This section of the report provides information on the future right of way needs and general transportation improvements. The information contained in this section is at a high-level. Detailed information about the timing and location of traffic control devices is not provided. As development occurs, the City can request traffic studies from developers to show what traffic impacts (including need for additional roadway capacity and traffic control devices) result from proposed developments. **Appendix B** of this report identifies the process that was used to generate the overall traffic projections, assign it to the roadway network, and account for existing traffic on roadways within the study area.

Future Traffic Volumes

The proposed land uses in the study area result in a significant amount of new development that will add many trips to the transportation network in Phase 1 and Phase 2. The amount of traffic generated will require investment in local, regional and state facilities. The sections below identify future traffic volumes and the corresponding improvements needed to accommodate the proposed land uses.

The traffic volumes generated by the development found through the travel forecasting process and generated by other background growth are shown in **Figure 18**, and the total ADT on the area roadways is shown in **Figure 19. Table 3** shows existing roadways that will be over capacity based upon future development and background growth.

Table 3 – Future Traffic Volumes and Capacity Problems

Roadway	From	To	Design	Future Traffic Volumes	Capacity	Segment Above Capacity
US 169	CSAH 33	221st Avenue	4-lane rural expressway		36,000	Yes
CSAH 33	Western study limits	Western interchange approach area	2-lane rural		12,000 – 15,000	Yes
CSAH 33	Western interchange approach area	Eastern interchange approach area	4-lane divided		28,000 – 32,000	Yes
CSAH 33	Eastern interchange approach area	The east	2-lane rural		12,000 – 15,000	At capacity
CR 77	CSAH 33 intersection	South study limits	2-lane, rural		12,000 – 15,000	Nearing capacity
CR 121	CSAH 33	Eastern study	2-lane, rural		12,000 –	No

		limits			15,000	
Proctor Road	Old CSAH 33	213th Avenue	2-lane, rural – local road		<8,000	Yes
221st Ave	CSAH 1	US 169	2-lane, rural – local road		<8,000	Yes

As shown in the figures and Table 3, traffic volumes are expected to increase substantially based on land uses within the study area and general growth in surrounding areas. Most of the growth is anticipated to occur along US 169, CSAH 33 and 221st Avenue, with Proctor Road and CR 121 also expecting to see increases in traffic as connections are made between CSAH 33 and 221st Avenue. Concentration of traffic in these areas is a result of their proximity to the proposed land use changes as well as lack of other continuous routes within the community.

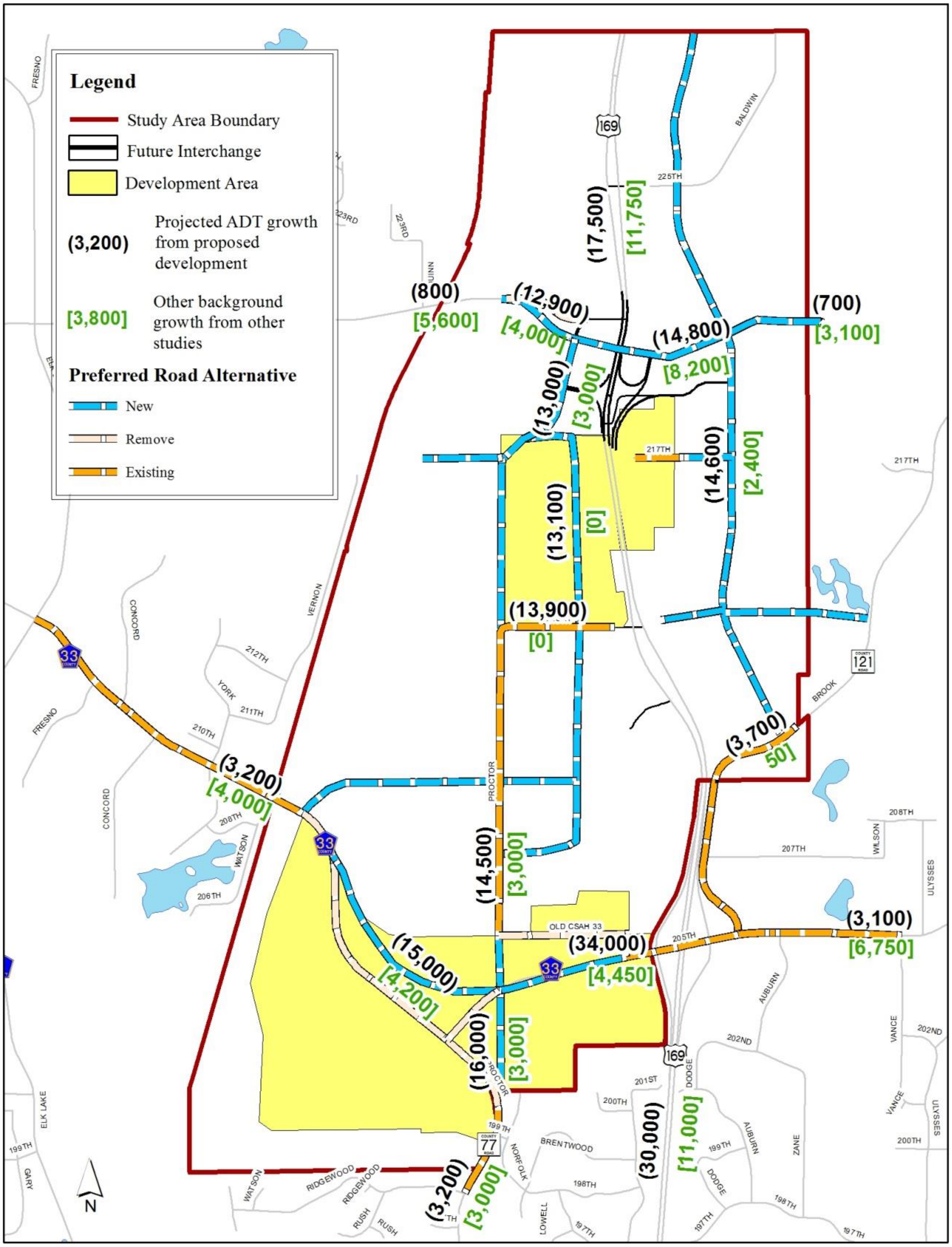


Figure 18: Background Traffic Growth and Development Traffic Growth

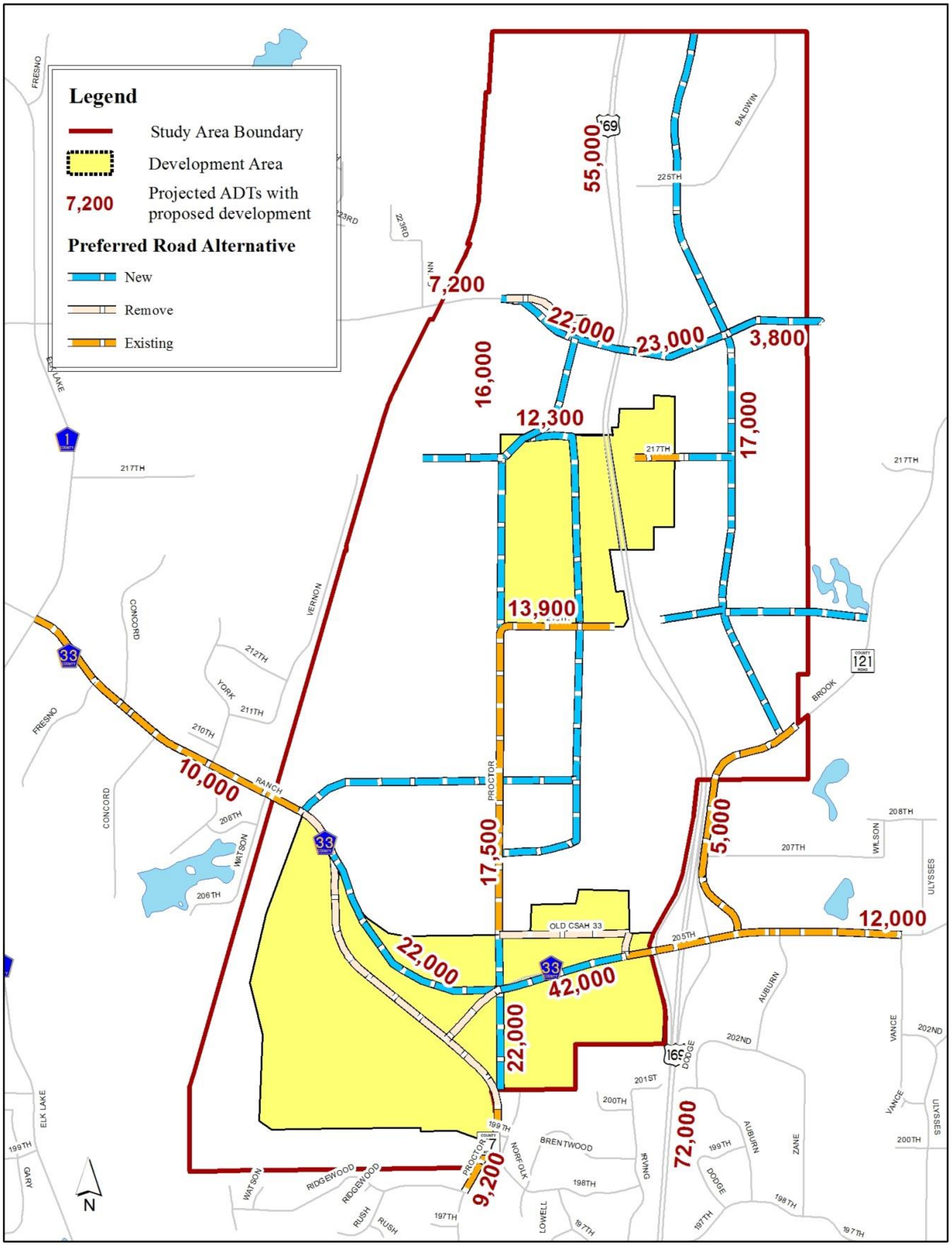


Figure 19: Projected ADTs -2040

Findings
Results from the travel forecasting process indicate that the existing roadway network will not be able to accommodate future traffic demand without additional improvements to the area highway system. The following summarizes findings related to the transportation network and access in the area of the study area:

- The proposed land uses are more intense than current zoning and will result in more trips being generated than previously identified.
- Interest by property owners, elected officials and the public included realigning CSAH 33 with Proctor Road.
- US 169, CSAH 33, Proctor Road, 221st Avenue, CR 121 and the proposed eastern backage road need to function at a high-level in order to accommodate future traffic demand due to the lack of supporting continuous north-south and east-west routes within the community.
- Improvements will need to be made to the local, regional and state transportation systems. Coordination among the agencies to build the necessary improvements will be critical in supporting proposed land uses.
    - The City's Comprehensive Plan identifies a number of roadway extensions, new alignments/routes and access management techniques that will need to be incorporated into the future transportation network for the area.

    - The US 169 EA/EAW identified the long-term need for an interchange at 221st Avenue, construction of backage roads, extending Proctor Road to 221st Avenue, and for upgrading US 169 to a freeway facility. These improvements are needed to support proposed development in the area.

Without improvements to the roadway network, portions of the roadway network will be over capacity (i.e., roadway will become congested). Existing roadways expected to experience congestion include:
    - CSAH 33 in the entire study area
    - US Highway 169 in entire study area
    - Proctor Road
    - 221st Avenue
    - CR 77

Recommendations

To ensure that the roadway network will work over the long-term (at least until the development of Phase I and 2 are completed), the following recommendations are made:

- Access on US 169 and on county roadways should be limited according to their functional classification to preserve mobility and maintain safety. MnDOT and Sherburne County have developed guidelines based on functional classification.

For US 169 this means that once an interchange is constructed at 221st Avenue, existing access points between CSAH 33 and 221st Avenue will be closed. Additionally, it means that no new access to US 169 will be allowed prior to interchange construction. If safety becomes a problem at the existing at-grade access locations between CSAH 33 and 221st Avenue, MnDOT has the right to close access.

For county roadways, access is more complex. **Table 4** below shows Sherburne County access guidelines for urbanizing areas. This information is from the County's Transportation Plan which shows all of the study area as urbanizing. Please refer to the Sherburne County Transportation Plan for additional details on access guidelines.

Table 4 – Sherburne County Access Spacing Guidelines for Roadways in Urbanizing Areas

Area Type	Functional Class	Facility Type	Intersection Spacing		Signal Spacing	Private Access	Turn Lanes
			Full Median Opening	Right-in/out			
Minor Arterial Routes							
Urbanizing	Minor Arterial	Divided	¼ Mile	1/8 Mile	¼ Mile	By exception or deviation only	Yes
		Undivided	¼ Mile	1/8 Mile	¼ Mile	660 feet minimum or subject to conditions	Yes
Collector Routes							
Urbanizing	Collector	All	¼ Mile	NA	¼ Mile	660 feet minimum or subject to conditions	Yes
Local Routes							
Urban	Local	All	300 – 660 feet dependent upon block length		As warranted	Spacing from any intersection should be at least 330 feet	Yes
Rural	Local		¼ mile		NA	Spacing from any intersection	Yes

					should be at least 330 feet	

- The City of Elk River should develop its own spacing guidelines for local roadways within the study area to ensure mobility and safety on its facilities.

- The supporting roadway network should be continuous where possible so that local trips can avoid having to access US 169 in the study area.
- Intersection control will be determined as growth and development occur. Adequate space at proposed roadway intersections should be preserved to accommodate future traffic signals and/or roundabouts.
- Right of way along city, county and state facilities should be acquired or preserved in order to ensure that adequate capacity can be provided for in the future, including opportunities for pedestrians and bicyclists. As plats for development are submitted, the full right of way area should be noted, not just the amount of right of way needed at the time of the parcel's development.

Figure 21 shows the proposed roadway network needed to accommodate the Phase 1 and 2 planned land uses, as well as those that would be needed beyond the 2040 timeline. As this area develops, it will be important to include infrastructure for pedestrian and recreational bicycle movement by including trail on one or both sides of each roadway. This translates into the following for right of way preservation:

- Urban 2-Lane Roadway: 75 feet minimum. This allows for two travel lanes, turn lanes in both directions at intersections, shoulders (including curb), a boulevard and a trail on one side of the roadway. Assumes an eight-foot boulevard and a 10-foot trail. Accommodates between 8,000 – 10,000 cars a day.

- Urban 3-Lane Roadway: 100 feet minimum. This allows for two travel lanes, a center turn lane, shoulders (including curb), a boulevard and a trail on one side of the roadway. Assumes an eight-foot boulevard and a 10-foot trail. Accommodates between 15,000 – 18,000 cars a day.

- Urban 4-Lane Divided Roadway: 120 feet minimum. This allows for four travel lanes, left- and right-turn lanes at intersections, center median, shoulders (including curb), a boulevard and a trail on both sides of the roadway. Assumes an eight-foot boulevard and a 10-foot trail. Accommodates 28,000 – 32,000 cars a day.

- Urban 6-Lane Divided Roadway: 150 feet minimum. This allows for six travel lanes, left- and right-turn lanes at intersections, center median, shoulders (including curb), a boulevard and a trail on both sides of the roadway. Assumes an eight-foot boulevard and a 10-foot trail. Accommodates approximately 40,000 – 44,000 cars a day.

- 221st Avenue Interchange: Preserve based on concept developed as part of the US 169 EA/EAW.

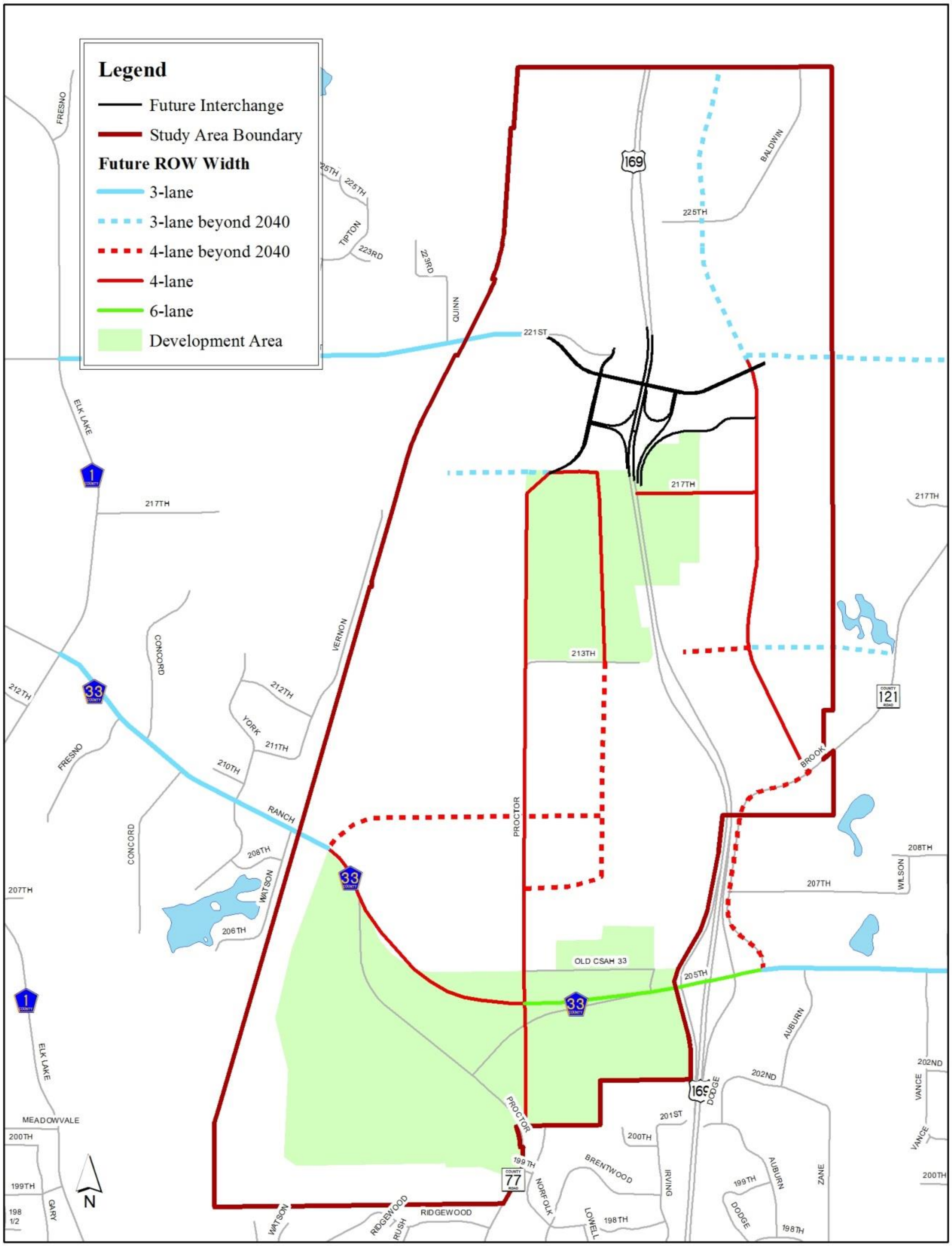


Figure 20: Proposed Roadway Network

Utility Analysis

Sanitary Sewer System

The final reclamation area grading plan shows that the study area will slope from a higher elevation on the south end to significantly lower elevations in the northerly areas which make gravity service from the entire gravel mining area to the existing WWTF infeasible. The very southerly portion of the study area (south of Old CSAH 33) is located on the highest ground and may have the elevation necessary to facilitate gravity flow to the City's sanitary sewer infrastructure, but the existing pipes with the urban service may not have the capacity to collect and convey sewage to the plant. The existing system should be fully evaluated to determine if sufficient capacity exists for conveyance of sewage from this portion of the study area.

The existing (2014) operational capacity of the WWTF would not allow for treatment of sewage generated in the entire study area. According to the Wastewater Treatment Facility Plan completed in 2013, upgrades planned for the WWTF will provide the capacity to treat wastewater generated south of Old CSAH 33. At this time, additional upgrades to the WWTF to treat the remaining areas in the study area have not been planned.

Growth will likely occur from south to north. A logical approach to providing flexible sanitary sewer service to much of the developable area would be a gravity system that conveys flow to the low areas and a major lift station at that point to pump wastewater flow into the collections system. To facilitate the use of lift stations capacity improvements in the existing trunk system will be necessary or an interceptor sewer to the WWTF will be required to provide the necessary collection and conveyance capacity. Another approach may be temporary lift stations until such time that the investment in a trunk sewer to the north, a major lift station in the north, and a forcemain back to the south is warranted. Potential locations of lift stations are indicated in **Figure 22.**

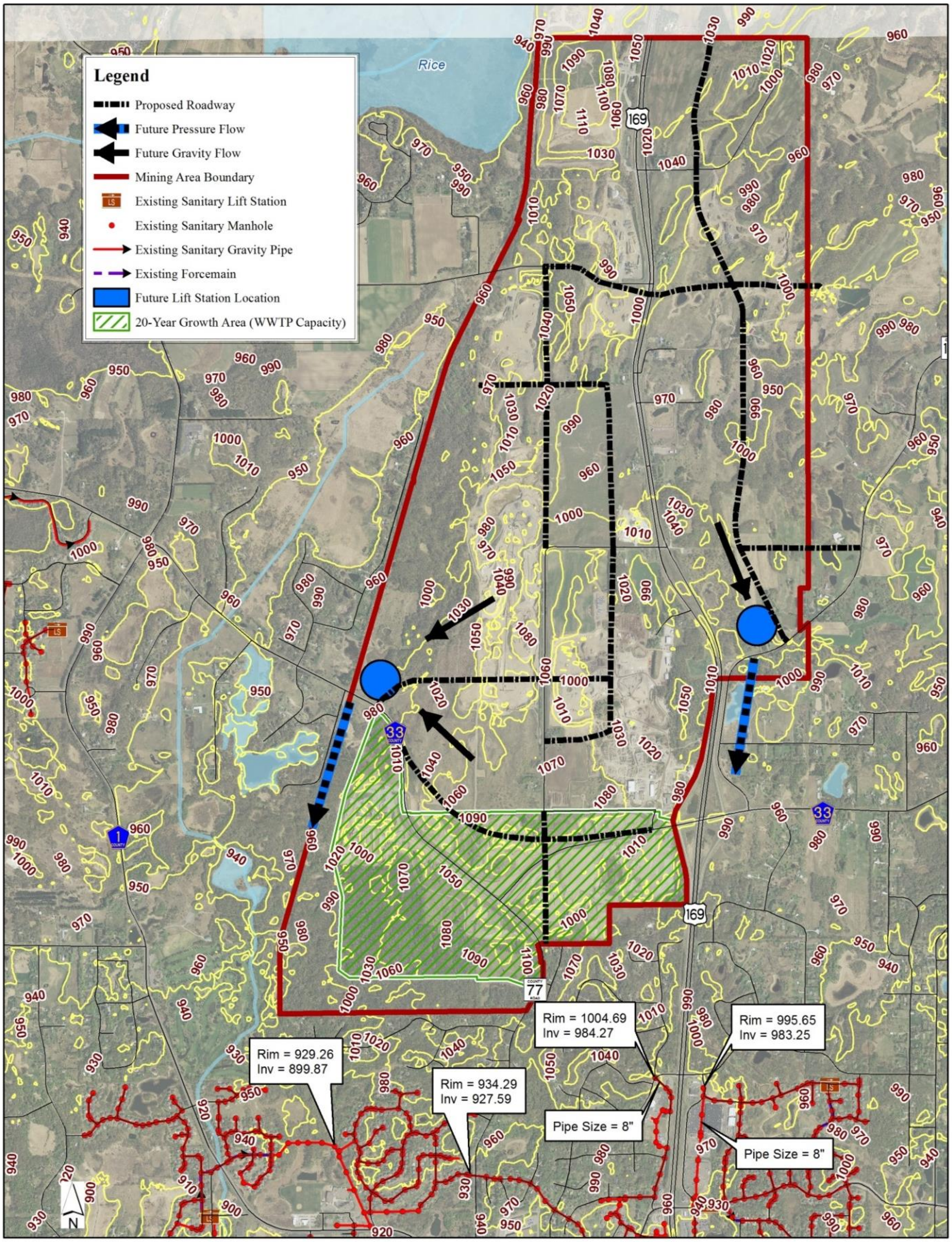


Figure 21: Sanitary Sewer Improvements

Water System

Slopes from south to north will not be a constraint for water system development, unlike that of the sanitary sewer. Based on the high ground elevations in the southern portion of the study area and the pressure in the existing system, it will be necessary to create a higher pressure zone. A water tower will eventually be needed to provide adequate pressure to the high ground areas and fire flow volume for the remaining study area. Depending on the extent and pace of development, a second water tower could be sited further to the north to provide additional fire flow volume.

Based on the size of the study area, several additional wells and water treatment plants (WTPs) will need to be constructed to provide for the water demand of the area. The timing of the wells and WTPs will be dictated by the pace of development. Because of landfilling activities in the area, care will have to be taken in the siting of new wells. The recommended phasing of this improvement is discussed in further detail below.

Initially water should be provided to the initial expansion areas by a pumping station that pumps water from the existing system. The pumping station would pump continuously to maintain pressure. After there is sufficient development to warrant it, a water tower should be constructed. Wells and WTPs should be constructed when water demand warrants their construction. Following construction of the wells and WTPs, the pumping station could be retained as an emergency means of providing water to the expansion area. Potential locations of a water tower or booster station site are indicated in **Figure 23.**

Assuming 80 to 100 gallons per day usage for residential development, and 800 to 1,000 gallons per acre per day for highway business, and 1,000 to 1,200 gallons per acre per day for commercial/industrial flex, the following water and wastewater needs were identified to serve Phase 1 and Phase 2.

	Acreage-Phase 1	Acreage-Phase 2	Homes	Population	Avg water usage (g/d)	Water usage range (g/d) Phase 1	Total water usage range (g/d) Phase 2
Low density residential (1.5 u/a)	136	0	204	569	80-100 (per person)	45,520 to 56,900 g/d	
Medium density residential (4 u/a)	138	0	552	1540	80-100 (per person)	123,200 to 154,000 g/d	
Highway Business	78	114	NA	NA	800-1000 (per acre)	62,400 to 78,000 g/d	91,200 g/d to 114,000 g/d
Commercial/Industrial Flex (50/50)	178	80	NA	NA	1,000-1,200 (per acre)	178,000 to 213,600 g/d	80,000 g/d to 96,000 g/d
TOTAL	530 acres	194 acres	756 units	2,109 people		**409,120 g/d to 502,500 g/d**	171,200 g/d to 210,000 g/d

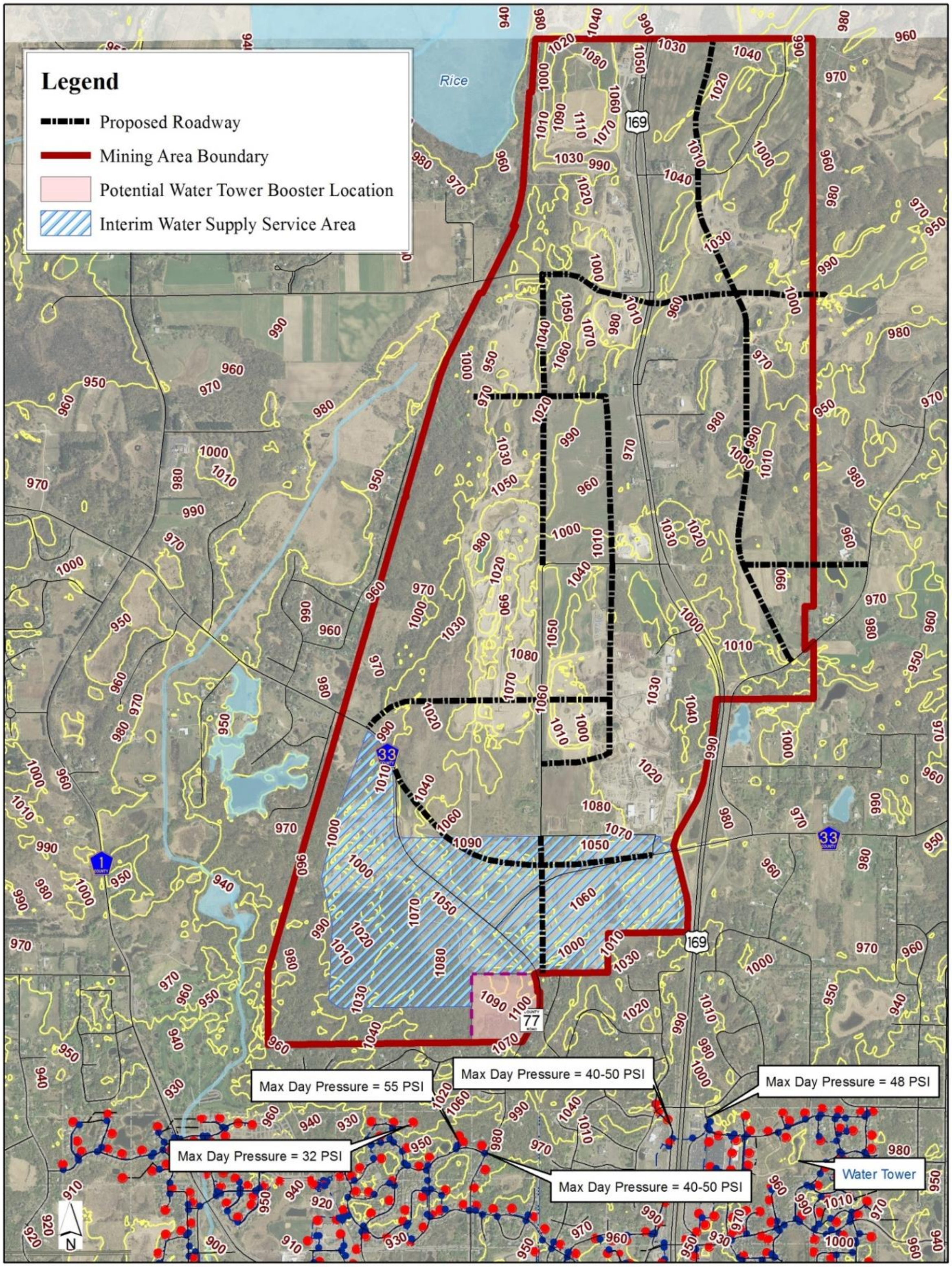


Figure 22: Proposed Water Upgrades

Final Reclaim Grading Analysis

One of the priorities of the study is to provide final reclaim grades to assist the mining companies in preparing their sites. It is important to note that the scope of the study does not provide the detail necessary to facilitate contours for final development, but does provide guidance for the area.

There are several obstacles that could inhibit broad scale changes in final reclaim grades including the existing transmission towers, cell towers, and existing roadway systems primarily on the southerly portion of the study area. The re-location of these transmission lines and towers should be examined as the property around it develops, given the challenges with grading around these areas. Another inhibiting factor is the multiple adjacent property owners as well as the varying degrees of reclaiming and property use. Without a common understanding and partnership between the property owners, both public and private, it may be difficult to accomplish broad scale grade changes throughout the study area. The grading plan provided with the report does take into consideration the proposed roadways as well as the stormwater management areas. To provide a more thorough final reclaim grading plan, further discussion with the stakeholders in the study area will be necessary.

Recommended final reclamation grades are shown on **Figure 24.** A zoomed in version of the southern area of the same map is shown in **Figure 25.**

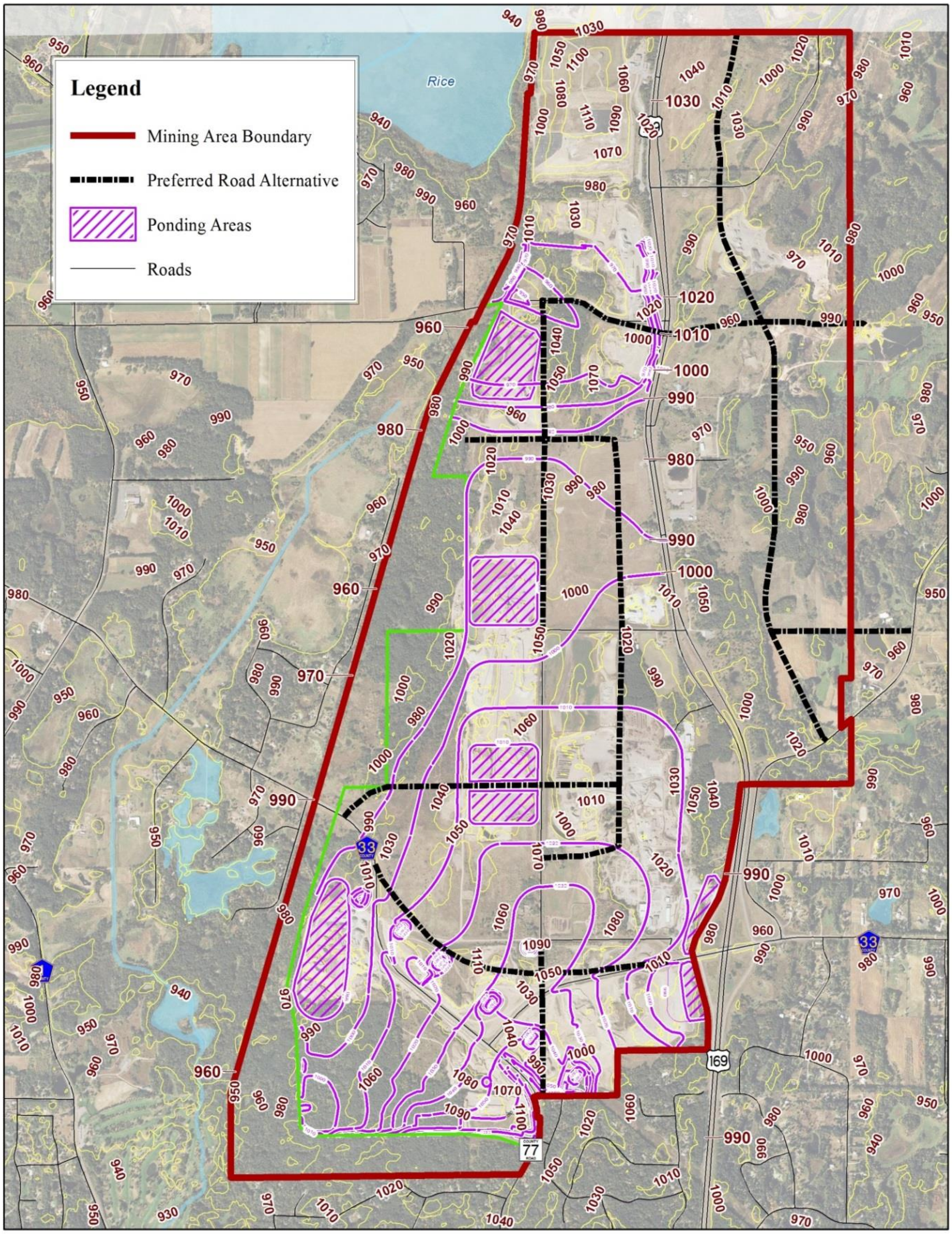


Figure 23: Final Reclamation Plan

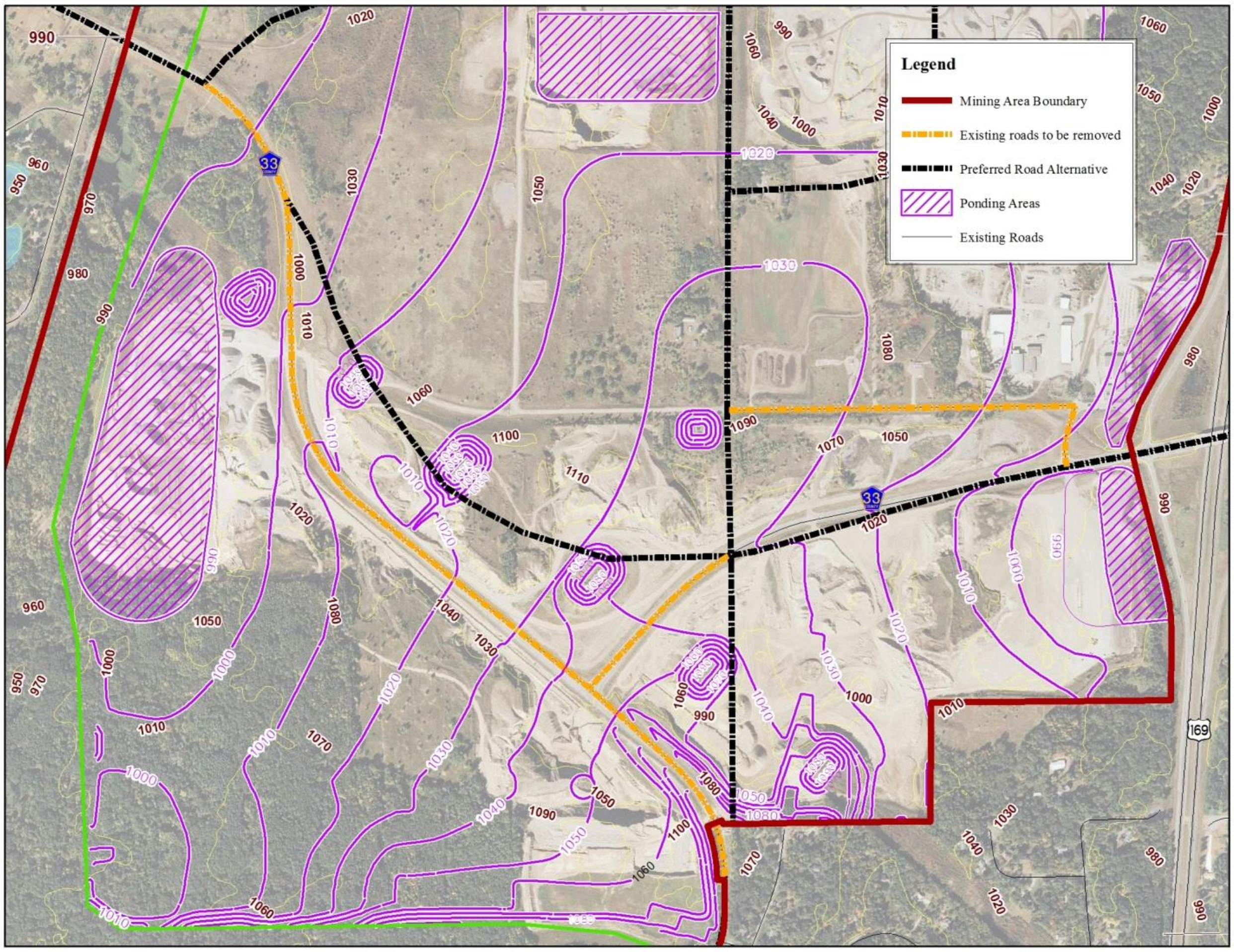


Figure 24: Final Reclamation Plan-Zoomed In to Southern Portion

Stormwater Analysis

Trunk Highway 169 generally forms the drainage divide for the Elk River Gravel Mining Area. Proposed development on the west side of TH169 travels overland to the west to the existing system of county ditches. Flow in the ditches travels south through Woodland Trails Park to Upper Orono Lake. Upper Orono Lake is listed as impaired by the Minnesota Pollution Control Agency (MPCA) for nutrient/eutrophication biological indicators. Upper Orono Lake connects to Lower Orono Lake, which is also impaired for nutrients. The lakes discharge into Elk River (impaired for E coli) which finally discharges into the Mississippi River (impaired for PCB in fish tissues). The east side of the Gravel Mining Area travels east to a system of county ditches that outlet into Trott Brook. Trott Brook is not currently listed by the MPCA as impaired.

Based on the Sherburne County Natural Resource Conservation Service (NRCS) Soil Survey the soils in the study area are generally characterized as hydrologic soil group (HSG) A. The existing land use is primarily gravel/sand mining, with woods and agricultural land use along the edges of the study area.

When development occurs, the MPCA National Pollution Discharge Elimination System (NPDES) Construction General Permit requirements must be met. The City of Elk River and Sherburne County currently do not have any additional stormwater requirements.

The ponding footprints shown on **Figure 26** provide best locations for considering regional stormwater pond opportunities and would generally meet the NPDES Permit requirements for development within Phases 1 and 2.

Due to the high infiltration potential of the existing soils, it is recommended that infiltration be utilized for meeting the stormwater requirements. Existing depressions where gravel mining is occurring are a good potential location for regional stormwater ponding, as shown on **Figure 26**. These sites were selected based on the proposed grading plan (existing low-lying areas) and the direction of existing drainage.

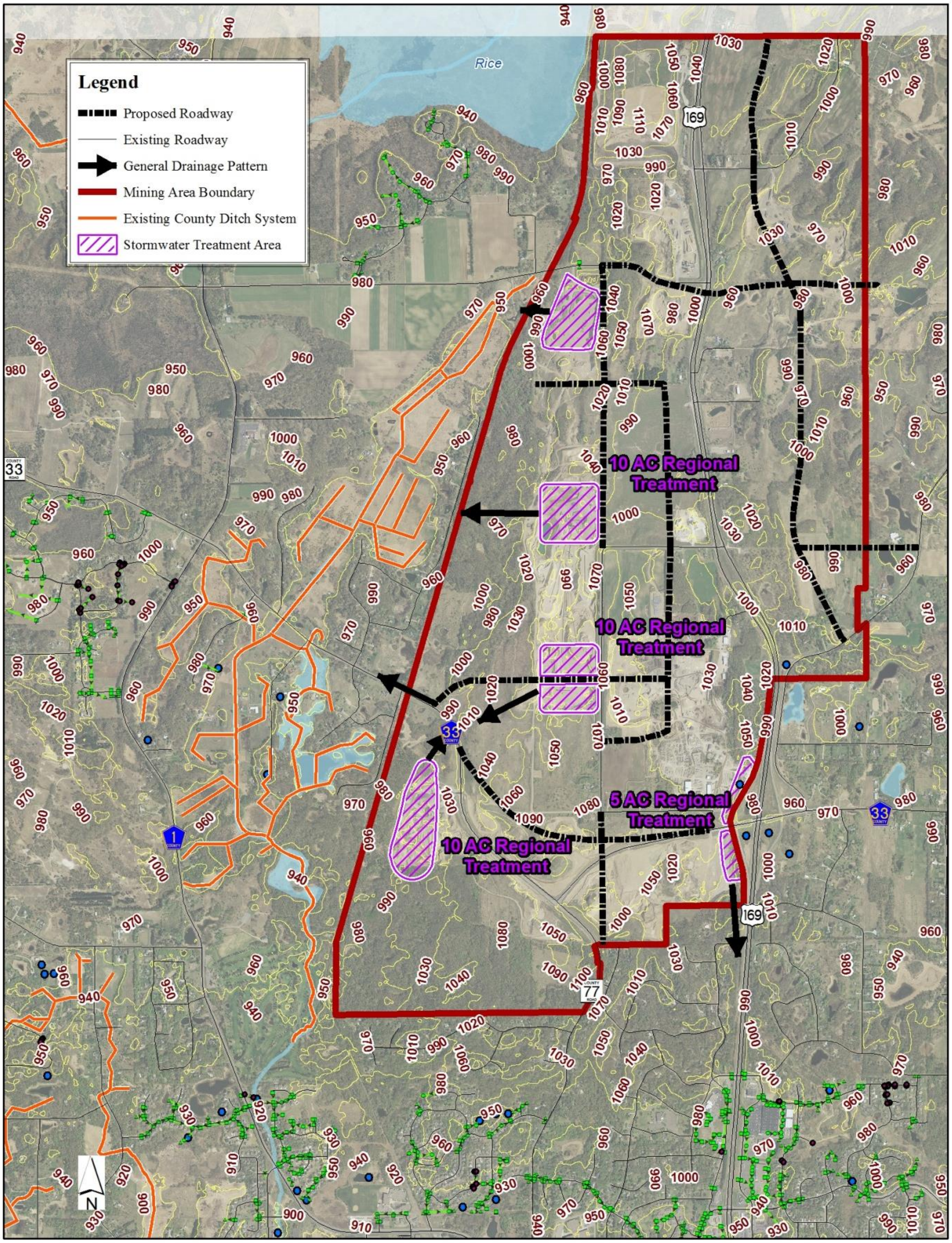


Figure 25: Stormwater Improvements

Conclusion and Recommendations

Given the size of the study area, and the significant investment needed for sewer, water, stormwater, and transportation to adequately serve the final land use scenario, a key recommendation from this study is to identify and prioritize needed investment by phases. Phase 1 is that area immediately available for development, where existing infrastructure can be used, analyzed, and expanding upon to adequately serve development. Phase 2 is an area that has completed mining operations, and therefore is available for future development, however, requires significant infrastructure investment. Phase 3 is the remaining portion of the site, which will not be done mining for at least 20 years.

Rural Residential Development

There is an opportunity for immediate residential development in the areas on the eastern side of US 169. Any development that is allowed without sanitary sewer service should be designed as a cluster development, with a community septic system. This will allow for immediate residential development and easy connection in the future, once utilities are available.

Phase 1

Phase 1 is the area generally expected to develop first (in 0 to 15 years), and is shown outlined on **Figure 17**. This area is approximately 530 acres in size, and consists of 274 acres of urban residential and 256 acres of commercial and commercial/industrial flex space. This study anticipates the majority of the immediate demand for development to be low or medium density residential, but also acknowledges the desires of the community to have an industrial park area to provide jobs, tax base, and business expansion opportunities within Elk River. These 256 acres will accommodate approximately 679, 000 square feet of new commercial opportunity around the interchange of CSAH 33 and US 169, and almost 2 million square feet of commercial or industrial development.

Utilities

Portions of this area can most likely be immediately served by the sanitary sewer pipes located in close proximity to the Phase 1 area, although further detailed study would clarify the exact amount of capacity and the exact location to access that trunk line. When upgrades were made to the Waste Water Treatment facility, the majority of Phase 1 was included in the capacity calculations, making Phase 1 the most feasible for immediate development without the need to increase capacity at the facility. Given its location on a portion of high elevation, it is possible this area could be served by gravity sewer with no lift station needed. However, it should be noted that the capacity of the sanitary trunk lines that serve this area was planned to provide capacity to future development to the west of the study area.

Should development occur to the west prior to development in the study area, the following improvements may be needed to adequately provide utilities to Phase 1. More detailed study will be needed as development is proposed.

- A trunk line extension from the wastewater treatment facility extending from the existing Waste Water Treatment Plant to the Phase 1 area.

- In the short term, a water pumping station could be utilized that pumps water from the existing system. The pumping station would pump continuously to maintain pressure, which should be retained as an emergency means of providing water to the expansion area.
- As development warrants, a water tower will be needed during Phase 1.
- Additional wells and a water treatment plant (WTP) should be constructed when water demand warrants their construction.
- Utilize existing grades to consider regional stormwater ponds.

Transportation

With the first phase of development, the City should try to preserve the right of way identified in **Figure 21** as plats come in and as other improvements are made. In terms of development, it is expected that the more intensive uses will occur near CSAH 33 and the US 169 interchange.

As a result, it is expected that the following transportation improvements will be needed by the end of Phase 1:

- Converting CSAH 33 to a four-lane, divided roadway from Ranch Road connection through the intersection with CR 121. This upgrade should allow for the eventual conversion to a six-lane roadway. It may be that the roadway is built to a six-lane facility but striped as a four-lane until such time as funding is available to widen the interchange bridge and its ramp terminals.
- Construct Proctor Road as a three-lane roadway (at a minimum) north of CSAH 33 to the connection with 221st Avenue. It may be that the roadway is widened enough to accommodate the eventual four-lane divided facility but is striped as a three-lane roadway.
- Construct Proctor Road as a four-lane, divided roadway south of CSAH 33 through the southern development area of Zone 1.
- Construct 221st Avenue as a four-lane divided roadway from Proctor to the US 169 intersection.

The County and the City should continue to monitor the development situation – the timing of development and funding availability for some of the improvements may dictate that the roadway configuration for 2040 be built by the end of Phase 1.

Phase 2

While Phase 1 has relatively good access to existing infrastructure, significant investment will be needed both publicly and privately, to provide transportation and utility access to Phase 2. Based on input from mining companies, mining is already completed in this Phase 2 area, and could be made available for immediate development. Phase 2 is 194 acres total, and is guided for industrial and commercial uses. This area could net 800,000 to 900,000 square feet of industrial and business/commercial space. Its location located near an interchange allows for either type of development to be successful in that area.

Its location does not access the needed infrastructure to develop and the timing of development will be dependent on the completion of mining operations (and subsequent development) of areas south of the Phase 2 area.

Utilities

Utilities are not immediately available to Phase 2 or 3, and significant investment, either public or private, will be needed to serve this phase. Additional capacity will be needed for the wastewater treatment plant, as well as the trunk lines to serve that plant. Several more wells and water towers will be needed, and detailed projections will be needed to determine the number and amount of such upgrades. From a utility standpoint, Phase 2 and 3 could be planned for concurrent through a detailed Utility Study.

Transportation

With the second phase of development, the City should preserve any right of way it was unable to obtain during Phase 1 in order to limit additional costs to the City, County or State.

In terms of development, it is expected that the more northern areas will develop which will put increasing traffic pressure on 221st Avenue, US 169, Proctor Road and needed backage roadways on the east side of US 169. In addition, it is anticipated that CSAH 33 will be expected to have additional traffic demands due to background growth and development that was not completed in Phase 1.

The following improvements are expected to be needed by the end of Phase 2:

- Convert CSAH 33 to a six-lane, divided roadway from Proctor Road through the CSAH 33 interchange
- Upgrading the interchange at CSAH 33 to accommodate six lanes.
- Construct an interchange at 221st Avenue.
- Construct 221st Avenue east of the new interchange. It should be constructed as a four-lane, divided roadway to at least the backage road connection.
- Construct eastern backage road as a three-lane roadway to CR 121. It may be that the roadway is widened enough to accommodate the eventual four-lane divided facility but is striped as a three-lane roadway.
- CR 121 from the new frontage road connection to CSAH 33 should be upgraded to a three-lane facility. It may be that the roadway is widened enough to accommodate the eventual four-lane divided facility but is striped as a three-lane roadway.

The City will need to monitor Proctor Road north of CSAH 33. As traffic volumes approach 18,000 daily trips, congestion and safety may indicate the need to widen the roadway to four lanes.

The county and the city should continue to monitor the development situation – the timing of development and funding availability for some of the improvements may dictate that additional capacity should be constructed (four-lanes on Proctor, CR 121 and eastern backage road) at the time the other improvements are made.

Phase 3

The remaining portion of the gravel mining study area is shown in Phase 3. Most of this area will not be readily for develop for at least 15 years (post 2040) and does not have access to utilities. However, this study identified general right of way, possible regional stormwater ponding areas, and outlines general needs for utilities, as shown on **Figures 21, 22, and 23**. It is recommended that more in-depth studies occur for this area to better understand long-term needs as Phases 1 and 2 progress.

Appendix A: Public Involvement Summary

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Appendix B: Traffic Projection Process

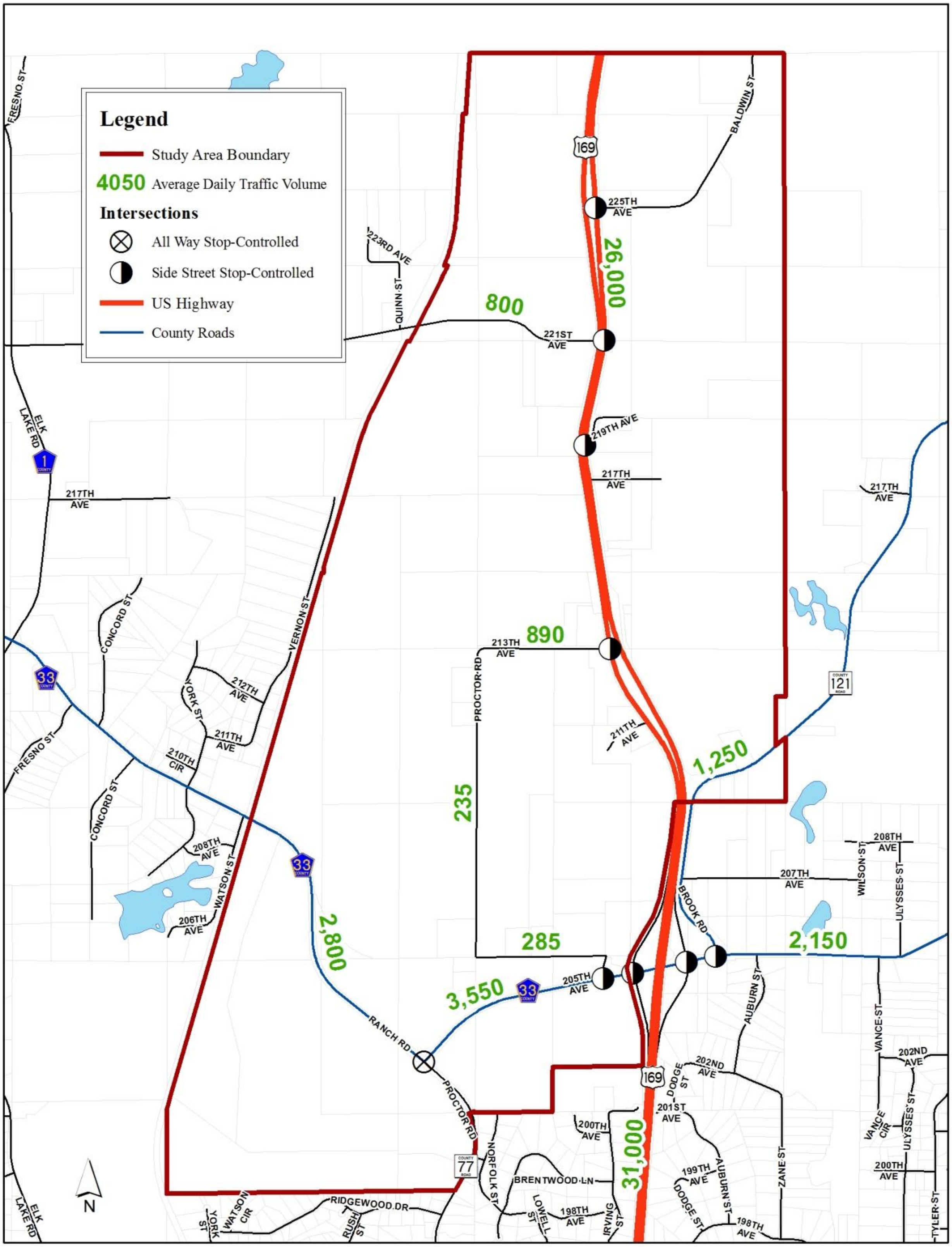
Daily traffic projections were developed to assess the roadway facilities needed to support traffic by the proposed land uses. In order to estimate the traffic impacts of the proposed land uses within the study area, it is also necessary to understand the expected background traffic growth. The traffic projection process consists of the following:

- Existing traffic volumes
- Background traffic growth
- Trip generation - site-generated traffic
- Trip distribution of site-generated traffic
- Mode choice
- Traffic assignment of site-generated traffic

More detail on these steps is provided in the paragraphs below.

Existing Traffic Volumes

Existing traffic volumes are shown in **Appendix B – Figure 1**. As noted on the maps, volumes on US 169 in the study area range between approximately 26,000 and 31,000, with the higher volumes concentrated closer to CSAH 33. Traffic volumes on CSAH 33 range between approximately 2,000 and 4,000 cars a day, with the higher volumes on the west side of the interchange. These volumes are below the capacity of the roadway, so congestion on this route is fairly limited. Volumes on the remaining roadways within the study area are generally below 1,000 cars a day. Traffic counts were from 2013 MnDOT Traffic Flow Maps and generally represent traffic data collected between 2011 and 2013.



Appendix B - Figure 1: Existing Traffic Volumes

Background Traffic Growth

Traffic volumes for the year 2030 were forecasted as a part of Sherburne County's Transportation Plan. This plan was completed in 2007 – at a time when growth was just starting to slow and the economy was starting to decrease. However, the data used to complete the County's plan (including 2030 traffic forecasts) were developed when the economy was robust and growth in traffic had been occurring. This is reflected in the MnDOT Traffic Flow Maps for the time period between 2000 and 2013. The end result is that traffic volumes in 2013/2014 are very similar to the traffic volumes in 2007. Because economic growth was limited between 2007 and 2014, it is expected that the traffic growth originally projected for 2030 is likely to occur at a later time. The 2030 forecast traffic volumes produced in 2007 more likely represent 2040 year forecasts.

The traffic forecasts on US 169 produced for the County Transportation Plan included some growth in the proposed mining area development. Because this is the case, the trip generation caused by the proposed land uses for US 169 in this study is assumed to be somewhat accounted for in the County's Transportation Plan as background traffic growth.

Trip Generation

Information from the proposed land uses in the study area is used to determine the amount of new trips generated by the proposed development versus what existing land uses currently generate. Trip generation is estimated by applying trip generation equations found in the Institute of Transportation Engineers' Trip Generation Manual to the amount of commercial, industrial, residential, and other useable space within the development area.

Trip generation rates in the Trip Generation Manual are given for stand-alone developments and do not differentiate between the source of the trips (new trips versus existing trips that are diverted due to the proposed development) and thus need to be adjusted to account for these factors. Three main trip generation adjustments are generally used to account for these factors: internal trip reduction, trips between analysis zones, and pass-by/diverted link trip adjustments.

Internal trip reduction captures the amount of trips that originate at one component of an analysis zone but terminate at another component in the same zone. Some examples of internal trip might be a trip from one retail store to another retail store in a shopping center or a lunch trip from an office to a restaurant located within the same group of buildings. Internal trips are most frequent in retail/commercial and mixed-use areas. According to guidance from the Trip Generation Manual, an internal trip reduction factor of 20 percent was applied to each zone with commercial uses present.

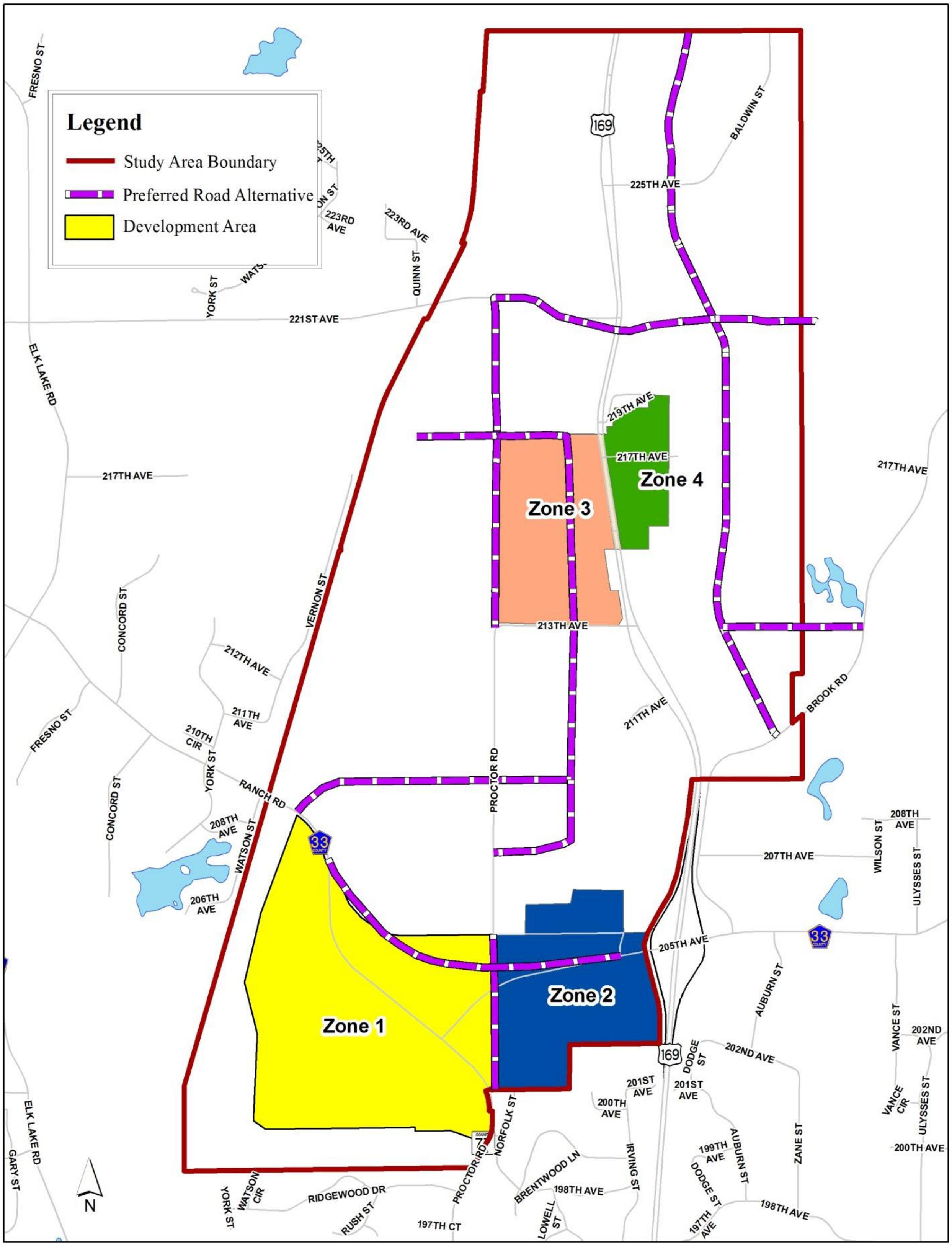
Trips between analysis zones are caused by trips traveling from one analysis zone to another without leaving the study area using roadways within the study area. For example, a trip between zones might include a person traveling from an office located in Zone 4 to a restaurant located in Zone 1 for lunch. NCHRP Report 684 includes data on the amount of trips that are attracted between land uses of various types within a study area (e.g., residential-to-retail trips or office-to-restaurant trips), and this data was used to estimate the amount of trips that would travel between analysis zones in the study area. After analyzing the trips between the different proposed land use types in the study area, it was determined that approximately 12 percent of the trips generated by the proposed land uses would be destined for another zone within the study area. **Appendix B – Table 1** shows the amount of trips between each analysis zone in the study area.

Appendix B – Table 1: Trips Between Analysis Zones

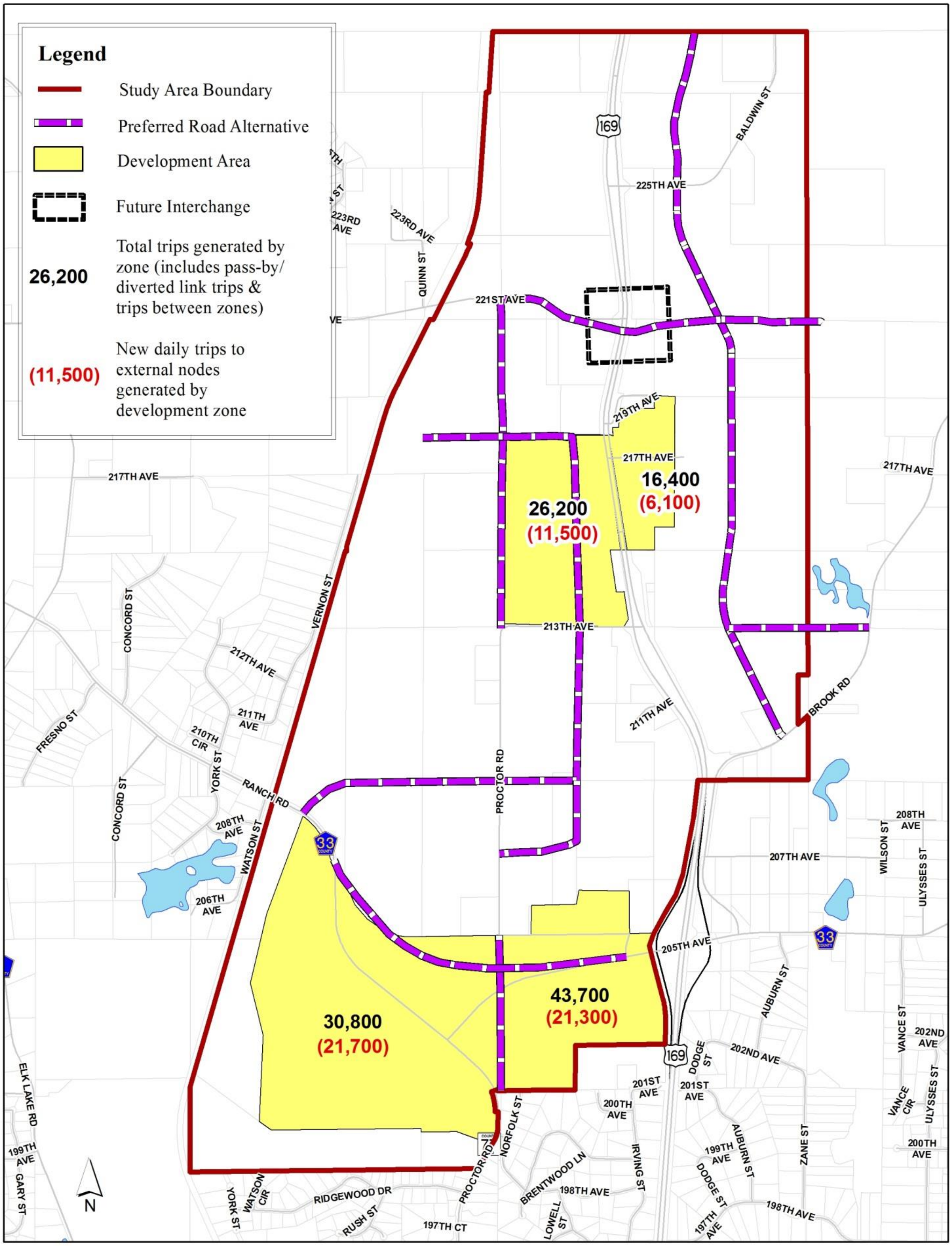
	Zone 1	Zone 2	Zone 3	Zone 4
Zone 1		2,600	1,360	780
Zone 2			1,400	1,260
Zone 3				600
Zone 4				
TOTAL	8,000			

Pass-by and diverted link trips are caused when a trip that would normally take one route without stopping at an intermediary point between its origin and destination is now persuaded to stop at the proposed land use as an intermediary point on its journey. A pass-by trip refers to when the proposed development causes a trip from an adjacent roadway to make an intermediary stop at the development. A diverted link trip refers to when the proposed development causes a trip from a non-adjacent roadway to make an intermediary stop at the proposed development. These trips are counted in the trip generation and are added to the access points to the development, but these trips are not generated on top of the traffic volumes already present in the roadway network. Pass-by/diverted link trips generally occur in commercial land uses. An example of a pass-by/diverted link trip is stopping at a grocery store on the way home from work when one would normally go directly home from work. In the study area, pass-by/diverted link trips are expected to be generated from existing trips using US Highway 169, CSAH 33, and Proctor Road. A pass-by/diverted link trip rate of 48 percent was applied to all highway commercial areas using guidance from the Trip Generation Manual. This rate was reduced to 18 percent for commercial/industrial flex areas.

The study area was broken up into four analysis zones as shown in **Appendix B - Figure 2**. The trip generation rate (including the internal trip reduction, trips between analysis zones, and pass-by/diverted link trip adjustment) for each zone is shown in **Appendix B Tables 2 through 5.** The tables also show the assumed land uses and trip generation within each land use type. **Appendix B – Figure 3** shows the total trips generated by each zone as well as the new trips that will go to areas outside of the development.



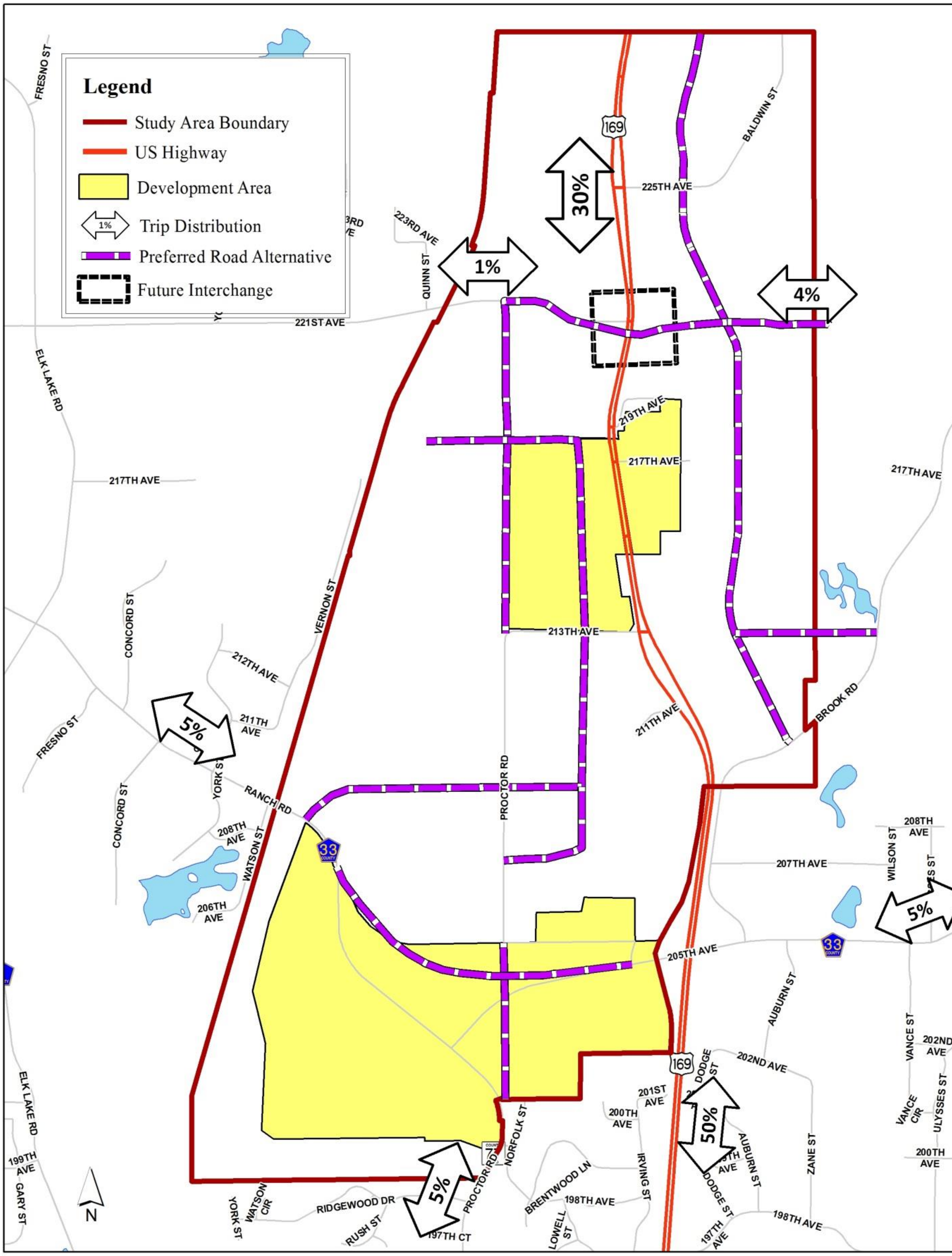
Appendix B - Figure 2: Traffic Analysis Zones



Appendix B - Figure 3: Total Trips by Zone

Trip Distribution

Trip distribution refers to the assignment of new trips to the surrounding roadway network. For this development area, trips were distributed to/from the roadways identified in **Appendix B – Figure 4**. The trip distribution was based on assigning traffic proportional to existing ADT volumes from MnDOT traffic volumes maps for nearby roadways. Engineering judgment also determined that this trip distribution is feasible. As would be expected, most of the trips (80 percent) are assigned to US 169. Approximately 10 percent are assigned to CSAH 33 and the remaining is distributed to other nearby roads.



Appendix B - Figure 4: Trip Distribution

Mode Choice

Here, trips between a given origin and destination are split into trips using different modes of travel including public transit and personal vehicles. Facilities and opportunities for transit are not expected to be provided in this area when the site is developed. There are no programmed local transit services identified and the Northstar Commuter Rail Station is too far for people to walk. Pedestrian and bicycle facilities are expected to be provided with development; however, the trips taken by bicycle or on foot are expected to be negligible compared to the amount of vehicle trips generated. This is consistent with other similar developments. As a result, mode choice is expected to remain similar to today.

Traffic Assignment

The final step in the process assigns the actual trips to specific routes. These routes are first determined based on the shortest travel times between origins and destinations. The assigned trip volumes are then compared to the capacity of each link to determine which links, if any, are congested. If a link is congested, and nearby routes are not, the trip was shifted to provide a better balance on the existing and proposed roadway network.

Appendix B - Table2: Zone 1, Phase 1, West Half Trip Generation

Land Use	Total Land Use Units	Time of Day	Trip Generation Rate (1)			Trips Generated			Internal Trip Reduction Within Zone (2)	Internal Trip
			Total	In	Out	Total	In	Out		Total
										Zone 1 - Phase 1 West
Low Density Residential	136.0 acres	Daily	9.52	4.76	4.76	1,942.00	971.00	971.00	20%	388.00
	204 units	AM Peak Hour	0.75	0.19	0.56	153.00	38.00	115.00		31.00
	(1.5 units/acre)	PM Peak Hour	1.00	0.63	0.37	204.00	129.00	75.00		41.00
Medium Density Residential	138.0 acres	Daily	9.52	4.76	4.76	5,256.00	2,628.00	2,628.00	20%	1,051.00
	552 units	AM Peak Hour	0.75	0.19	0.56	415.00	104.00	311.00		83.00
	(4 units/acre)	PM Peak Hour	1.00	0.63	0.37	552.00	348.00	204.00		110.00
Industrial	0.0 acres	Daily	57.66	28.83	28.83	-	-	-	20%	-
		AM Peak Hour	7.54	6.23	1.31	-	-	-		-
		PM Peak Hour	7.81	1.75	6.06	-	-	-		-
Highway Business	0.0 acres	Daily	427.08	213.54	213.54	-	-	-	20%	-
		AM Peak Hour	28.73	18.05	10.68	-	-	-		-
		PM Peak Hour	47.87	22.83	25.04	-	-	-		-
Commercial/ Industrial Flex	106.0 acres	Daily	295.76	147.88	147.88	31,350.00	15,675.00	15,675.00	20%	6,270.00
		AM Peak Hour	21.73	14.44	7.29	2,304.00	1,531.00	773.00		461.00
		PM Peak Hour	33.83	11.73	22.10	3,586.00	1,243.00	2,343.00		717.00

(1) Trip Generation Rate per unit (residential) or per acre (all others)

(2) % Internal Trip Reduction rate found by applying engineering judgment to Tables 7.1 and 7.2 of ITE Trip Generation Handbook 2nd Edition.

(3) % Pass-By/Diverted Link Trips = 60% X percentage of area per acre of commercial uses - % trips between zones. Value taken from average of Pass-By/Diverted Link trips found in Shopping Center land use in Table 5.6 of ITE Trip Generation Handbook 2nd edition.

(4) Pass-By/Diverted Link Trips = % Pass-By/Diverted Link Trips X (Trips Generated - Internal Trips)

Appendix B - Table 3: Zone 2, Phase 1, East Half Trip Generation

Land Use	Total Land Use Units	Time of Day	Trip Generation Rate (1)			Trips Generated			Internal Trip Reduction Within Zone (2)	Internal Trip	
			Total	In	Out	Total	In	Out		Total	
Zone 2 - Phase 1 East											
Low Density Residential	0.0 acres	Daily	9.52	4.76	4.76	-	-	-	20%	-	
	0 units	AM Peak Hour	0.75	0.19	0.56	-	-	-		-	
	(1.5 units/acre)	PM Peak Hour	1.00	0.63	0.37	-	-	-		-	
Medium Density Residential	0.0 acres	Daily	9.52	4.76	4.76	-	-	-	20%	-	
	0 units	AM Peak Hour	0.75	0.19	0.56	-	-	-		-	
	(4 units/acre)	PM Peak Hour	1.00	0.63	0.37	-	-	-		-	
Industrial	0.0 acres	Daily	57.66	28.83	28.83	-	-	-	20%	-	
		AM Peak Hour	7.54	6.23	1.31	-	-	-		-	
		PM Peak Hour	7.81	1.75	6.06	-	-	-		-	
Highway Business	78.0 acres	Daily	427.08	213.54	213.54	33,312.00	16,656.00	16,656.00	20%	6,662.00	3,3
		AM Peak Hour	28.73	18.05	10.68	2,241.00	1,408.00	833.00		448.00	2
		PM Peak Hour	47.87	22.83	25.04	3,734.00	1,781.00	1,953.00		747.00	3
Commercial/ Industrial Flex	72.0 acres	Daily	295.76	147.88	147.88	21,294.00	10,647.00	10,647.00	20%	4,259.00	2,1
		AM Peak Hour	21.73	14.44	7.29	1,565.00	1,040.00	525.00		313.00	2
		PM Peak Hour	33.83	11.73	22.10	2,436.00	845.00	1,591.00		487.00	1

(1) Trip Generation Rate per unit (residential) or per acre (all others)

(2) % Internal Trip Reduction rate found by applying engineering judgment to Tables 7.1 and 7.2 of ITE Trip Generation Handbook 2nd Edition.

(3) % Pass-By/Diverted Link Trips = 60% X percentage of area per acre of commercial uses - % trips between zones. Value taken from average of Pass-By/Diverted Link trips found in Shopping Center land use in Table 5.6 of ITE Trip Generation Handbook 2nd edition.

(4) Pass-By/Diverted Link Trips = % Pass-By/Diverted Link Trips X (Trips Generated - Internal Trips)

Appendix B - Table 4: Zone 3, Phase 2, West Half Trip Generation

Land Use	Total Land Use Units	Time of Day	Trip Generation Rate (1)			Trips Generated			Internal Trip Reduction Within Zone (2)	Internal Tr
			Total	In	Out	Total	In	Out		Total
Zone 3 - Phase 2 West										
Low Density Residential	0.0 acres	Daily	9.52	4.76	4.76	-	-	-	20%	-
	0 units	AM Peak Hour	0.75	0.19	0.56	-	-	-		-
	(1.5 units/acre)	PM Peak Hour	1.00	0.63	0.37	-	-	-		-
Medium Density Residential	0.0 acres	Daily	9.52	4.76	4.76	-	-	-	20%	-
	0 units	AM Peak Hour	0.75	0.19	0.56	-	-	-		-
	(4 units/acre)	PM Peak Hour	1.00	0.63	0.37	-	-	-		-
Industrial	80.0 acres	Daily	57.66	28.83	28.83	4,612.00	2,306.00	2,306.00	20%	922.00
		AM Peak Hour	7.54	6.23	1.31	603.00	498.00	105.00		121.00
		PM Peak Hour	7.81	1.75	6.06	625.00	140.00	485.00		125.00
Highway Business	66.0 acres	Daily	427.08	213.54	213.54	28,188.00	14,094.00	14,094.00	20%	5,638.00
		AM Peak Hour	28.73	18.05	10.68	1,896.00	1,191.00	705.00		379.00
		PM Peak Hour	47.87	22.83	25.04	3,160.00	1,507.00	1,653.00		632.00
Commercial/ Industrial Flex	0.0 acres	Daily	295.76	147.88	147.88	-	-	-	20%	-
		AM Peak Hour	21.73	14.44	7.29	-	-	-		-
		PM Peak Hour	33.83	11.73	22.10	-	-	-		-

(1) Trip Generation Rate per unit (residential) or per acre (all others)

(2) % Internal Trip Reduction rate found by applying engineering judgment to Tables 7.1 and 7.2 of ITE Trip Generation Handbook 2nd Edition.

(3) % Pass-By/Diverted Link Trips = 60% X percentage of area per acre of commercial uses - % trips between zones. Value taken from average of Pass-By/Diverted Link trips found in Shopping Center land use in Table 5.6 of ITE Trip Generation Handbook 2nd edition.

(4) Pass-By/Diverted Link Trips = % Pass-By/Diverted Link Trips X (Trips Generated - Internal Trips)

Appendix B - Table 5: Zone 4, Phase 2, East Half Trip Generation

Land Use	Total Land Use Units	Time of Day	Trip Generation Rate (1)			Trips Generated			Internal Trip Reduction Within Zone (2)	Internal Tr
			Total	In	Out	Total	In	Out		Total
Zone 4 - Phase 2 East										
Low Density Residential	0.0 acres	Daily	9.52	4.76	4.76	-	-	-	20%	-
	0 units	AM Peak Hour	0.75	0.19	0.56	-	-	-		-
	(1.5 units/acre)	PM Peak Hour	1.00	0.63	0.37	-	-	-		-
Medium Density Residential	0.0 acres	Daily	9.52	4.76	4.76	-	-	-	20%	-
	0 units	AM Peak Hour	0.75	0.19	0.56	-	-	-		-
	(4 units/acre)	PM Peak Hour	1.00	0.63	0.37	-	-	-		-
Industrial	0.0 acres	Daily	57.66	28.83	28.83	-	-	-	20%	-
		AM Peak Hour	7.54	6.23	1.31	-	-	-		-
		PM Peak Hour	7.81	1.75	6.06	-	-	-		-
Highway Business	48.0 acres	Daily	427.08	213.54	213.54	20,500.00	10,250.00	10,250.00	20%	4,100.00
		AM Peak Hour	28.73	18.05	10.68	1,379.00	866.00	513.00		276.00
		PM Peak Hour	47.87	22.83	25.04	2,298.00	1,096.00	1,202.00		460.00
Commercial/ Industrial Flex	0.0 acres	Daily	295.76	147.88	147.88	-	-	-	20%	-
		AM Peak Hour	21.73	14.44	7.29	-	-	-		-
		PM Peak Hour	33.83	11.73	22.10	-	-	-		-

(1) Trip Generation Rate per unit (residential) or per acre (all others)

(2) % Internal Trip Reduction rate found by applying engineering judgment to Tables 7.1 and 7.2 of ITE Trip Generation Handbook 2nd Edition.

(3) % Pass-By/Diverted Link Trips = 60% X percentage of area per acre of commercial uses - % trips between zones. Value taken from average of Pass-By/Diverted Link trips found in Shopping Center land use in Table 5.6 of ITE Trip Generation Handbook 2nd edition.

(4) Pass-By/Diverted Link Trips = % Pass-By/Diverted Link Trips X (Trips Generated - Internal Trips)